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Ethical Challenges of Deep Brain Stimulation: An Islamic Perspective

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Abstract: Arriving in the era of neurotechnology, different methods for brain stimulation are becoming increasingly recognized as viable ways for the treatment of neurological disorders, such as Parkinson's disease. However, many of the brain stimulation methods are now available readily on the market directly for non-medical consumer use without any medical supervision. Among the non-medical uses for the brain stimulation technology is cognitive enhancement, which is to augment a person's cognitive capabilities beyond what they are normally capable of. One brain stimulation technology that has not yet been made publicly available is deep brain stimulation (DBS), because of its invasiveness and need for expert surgical intervention to implant the electrodes and the pacemaker. Nevertheless, some studies have tested its effects on cognitive enhancement, which predicts its potential usability in the future for cognitive enhancement purposes. In this paper, we provided definitions and analysis of cognitive enhancement and DBS after which DBS was examined from an Islamic view of biomedical ethics taking into perspective the Islamic doctrine of *taklīf* (responsibility before God) and *ḍarūra* (necessity). As literature on Islamic scholarly views of DBS is virtually non-existent, we have also interviewed two Islamic scholars from prominent religious institutions to provide Islamic legal insights into the therapeutic and enhancement uses of DBS. This paper serves as a foundation based on which further research into religious views of brain stimulation and cognitive enhancement can be made.

Keywords: Deep Brain Stimulation; cognitive enhancement; Islamic bioethics; moral responsibility; medical necessity; personality change

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1. Introduction

The French philosopher Corine Pelluchon compares totalitarianism's intention to change the nature of man by creating a new race with transhumanism (Pelluchon 2019, 156). Popular culture is filled with images of cyborgs, bionic men, and "ghosts in shells", predicting a dystopic end to humanity as we know it and the merge of the human with the machine. In contrast with the grim image that bioconservatives and popular culture paint, Yuval Noah Harari optimistically states in "Sapiens" that Homo sapiens is overcoming its own limits, and that, "it is now beginning to break the laws of natural selection, replacing them with the laws of intelligent design" (Harari, 2015).

In this paper, the authors seek to discuss ethical challenges associated with the use of deep brain stimulation (DBS) with a focus on Islamic ethical views on DBS. After providing a detailed definition and examination of cognitive enhancement/neuroenhancement and DBS, the therapeutic and potential enhancement uses of DBS are discussed. First, the ethical conflicts of the potential change in personal identity are portrayed as it questions whether

the same person can be made morally responsible for his/her acts e.g., before God (*taklīf*). Then, the question arises whether the principle of necessity (*ḍarūra*) can be applied in the context of therapeutic use in non-life-threatening situations.

To date, Muslim scholars have engaged relatively little with transhumanist approaches (Kam 2023, 30). The majority of them reject transhumanist tendencies (Ibid.). Given the scarce sources, the authors interviewed two Islamic religious scholars from Tabah Foundation in Egypt and Mostafa Mahmoud Mosque (Giza, Egypt) on the permissibility of the use of DBS, which are not representative of the views of their respective institutions. However, the paper is intended to provide an incentive for further research into medical technology developments from a religious perspective.

2. Cognitive Enhancement/ Neuroenhancement

Humans possess a range of cognitive skills that support their existence, such as memory, thinking, and attention. These cognitive skills are key to survival, navigating the environment, and building relationships and communities. Some of the cognitive skills are domain-general whereas others are domain-specific, meaning that some cognitive skills are useful for solving problems irrespective of the field the problem lies in whereas other cognitive skills are only useful for solving problems in specific fields or specializations (Sala and Gobet, 2018). The modern world has introduced many changes that challenge human cognitive skills and their ability to keep up with the pace of life and technological advancement. One example of a challenge that the modern world has introduced is the confrontation with information overload from the internet. While the modern world has introduced these novel burdens and challenges, it has also provided technological means through which humans may potentially expand their cognitive abilities beyond the maximum known capacity, which gave rise to the idea of cognitive enhancement. In this respect, cognitive enhancement is favored by supporters of transhumanism, as the enhancement of both the physical and mental capabilities of humans is considered desirable (Bostrom 2014, 1-2).

Cognitive enhancement or neuroenhancement is defined as the use of various methods to improve memory, thinking, and attention. According to Colzato, cognitive enhancement is "the use of any (legitimate) means to reach one's personal best cognitive performance" (Colzato et al., 2018). Cognitive enhancement does not mean treatment of cognitive disorders, and the term is sometimes used to refer to "performance optimization", which is the ability to maintain proper cognitive functioning under situations of high demand and stress. For example, supporting the ability of a medical doctor to maintain focus during a night shift is seen as a problem of performance optimization rather than cognitive enhancement (Brunyé et al., 2020).

Cognitive enhancement can be achieved through medications, also known as pharmacological methods, or other forms of intervention, also known as non-pharmacological methods. While it is popularly perceived that cognitive enhancement can only be achieved through modern inventions and interventions, there are many strategies that have existed and were used by humans long before the modern period. One prominent example of a classic cognitive enhancer is caffeine, which contemporary biomedical research has shown is capable of improving memory (Sherman et al., 2016). Some studies have also demonstrated that *Bacopa Monnieri*, a traditional herbal medication, can improve the speed of attention (Kongkeaw et al., 2014). In addition to chemicals and herbs, ancient mnemonic practices were also demonstrated to enhance cognition. One such mnemonic practice is the memory palace (also known as the "method of loci"), where the person visualizes a place and places information or objects to be remembered within specific locations inside that place. Memory champions trained on

mnemonic practices are able to memorize great amounts of information within minutes (Dresler et al., 2018), showcasing neuroenhancement acquired through training and practice.

In addition to traditional methods, various modern methods have been developed that may have neuroenhancement effects. This includes medications that are normally used for the treatment of diseases, such as dementia and attention-deficit hyperactivity disorder (ADHD). However, it is debated whether these drugs do have cognitive enhancement effects (Esposito et al., 2021; Marazziti et al., 2021). The stimulation of the brain with electricity is another modern strategy that has been reported to possibly lead to cognitive enhancement. This strategy includes a diverse array of methodologies, ranging from ones that require surgery and insertion of electrodes into the brain and others that are non-invasive. Examples of brain stimulation techniques are deep brain stimulation (DBS), transcranial direct current stimulation (tDCS), transcranial alternating current stimulation (tACS), and transcranial random noise stimulation (tRNS), among others. Although these methods are normally used for the treatment of diseases, some studies have investigated their use for neuroenhancement purposes (Looi et al., 2016; Rego et al., 2022). The results of these studies have nevertheless been scrutinized due to the lack of uniform and standardized procedures (Buch et al., 2017). In the section below, we will cover the history, definition and use of one of the most classical brain stimulation methods, deep brain stimulation, as well as its therapeutic uses and potential enhancement uses.

3. Deep Brain Stimulation

In the 18th century, neurosurgeons have discovered that administering electrical current into the brain is connected to bodily movements. This electrical property of the brain gave birth to experiments that attempted to use electricity to treat various diseases. In 1938, the Italian neurologist Ugo Cerletti administered electrical current to the skulls of patients having severe psychosis, leading to the improvement of their condition (Sironi et al., 2011). Almost a decade later, Spiegel and Wycis optimized a surgical method that enabled the precise localization of specific brain regions. Electrical stimulation was then used along with this surgical method to identify "diseased" brain regions that were to be removed (lesioned) surgically (Sironi et al., 2011). This gave birth to the idea that electrical stimulation of brain areas can have therapeutic benefits, which is the entire premise of the deep brain stimulation (DBS) method.

According to Mayo Clinic, DBS is a procedure that involves the insertion of electrodes into brain regions (Mayo Clinic, n.d.). A device which is implanted under the skin in the chest produces periodical electrical pulses at regular intervals that travel into the brain areas through the electrodes. Numerous studies have demonstrated considerable benefits for DBS in the treatment of diseases, such as Parkinson's disease, epilepsy, and dystonia (movement disorder causing muscle contraction) (Fan et al., 2021; Salanova et al., 2015; Weaver et al., 2012). It was also shown to be beneficial for the treatment of obsessive-compulsive disorder (OCD) (Hamani et al., 2014), a disease where patients experience recurring thoughts and obsessions that lead to certain patterns of repeated behaviors that relieve these thoughts (National Institute of Mental Health, n.d.).

Deep brain stimulation has evolved as an alternative to medication for diseases where medications have proved to have limited to no benefit. It is also currently undergoing consideration as a treatment for other diseases, such as obesity, depression, and addiction. However, the use of DBS gave rise to many ethical concerns (Mayo Clinic, n.d.). First of all, DBS comes with a risk of side effects and complications. Some studies estimate that there is a risk of bleeding (hemorrhage) ranging from 1.3-4% and a risk of memory

impairment and speech impediments from 1.1-20% and 10.8-33%, respectively. A risk of depression reaching 25% was also reported (Schermer et al., 2011).

In addition to the abovementioned side effects, some studies have reported that patients receiving DBS acquired new personality traits they might feel is contrary to their own personality before receiving the treatment (Snoek et al., 2021; Thomson et al., 2021; Schermer et al., 2011). This notion is also affirmed by the persons surrounding the patient. Potential side effects caused by DBS in Parkinson's disease include increased aggression, selfishness, impulsivity and depression (Thomson et al, 2023), similar to conditions like high blood pressure or diabetes, which can lead to irritability or increased anger.

The changes in personality are not necessarily negative, in fact, they can even be positive changes, such as mood enhancement or an increase in libido (Schermer et al., 2011). So, the changes may be welcomed by the patients themselves. While they may not be common, the personality changes are currently not predictable, can often be problematic and can interfere with the patient's life. This raises many questions regarding what constitutes the definition of personality and identity which will be discussed later on in this article.

3.1. Therapeutic Uses of Deep Brain Stimulation

The positive therapeutic effects of DBS on diseases like epilepsy and Parkinson's disease leaves little room for dispute among neuroscientists and neurosurgeons. However, the use and effects of DBS on psychiatric disorders, such as depression, has been a source of dispute and controversy (Mocking et al., 2021).

In Parkinson's disease, the disease is known to be caused by the loss of neurons in the substantia nigra, a brain region involved in movement control. On the other hand, psychiatric disorders may show individual heterogeneity in the implicated brain regions (Segal et al., 2023; Maia et al., 2008) such as the one known for Parkinson's disease. This raises concerns regarding the efficacy of DBS for the treatment of psychiatric disorders.

Peter Sterling, a well-established neuroscientist, has expressed concerns and skepticism regarding the use of DBS for the treatment of depression and psychiatric disorders. In his articles in the magazine, "Mad in America", he stated that, unlike Parkinson's disease, none of the psychiatric disorders have established causal links with certain brain regions. This is supported by the observed diversity of implicated brain regions seen between individual patients having the same psychiatric disorder, something that studies found is explained by broader network effects (Segal et al., 2023). Based on this, Sterling concluded that "there is no rationale for any physical/chemical tinkering" (Sterling, 2023). Besides criticizing the foundation for interventions, Sterling commented that the studies utilizing DBS for the treatment of OCD only show small improvements and follow-up with patients for relatively short periods of time following the treatment with DBS (Sterling, 2022). This is supported by a meta-analysis that not only highlights the short duration of studies utilizing DBS but also cautioned that often the same individuals can be reported across different studies (Blomstedt et al., 2013). Indeed, the number of studies examining the long-term safety and efficacy of DBS as a treatment for OCD remains relatively low (Mar-Barrutia et al., 2022). What further complicates matters, Sterling comments, is that some researchers advocating the use of DBS for the treatment of psychiatric disorders have financial conflicts of interest, which casts doubt on the already small and short-term effects seen in the studies. When taking into consideration publication bias, where only positive results are published in journals and negative results remain unreported, this can raise caution regarding the use of DBS for the treatment of psychiatric disorders and shed light

on the need for further research to establish whether DBS is the appropriate approach for the treatment of psychiatric disorders.

DBS is an approach that is based on diseases where problems with specific brain regions are known and established (e.g., Parkinson's disease). However, this might be a one-size-fits-all approach that presumes that all brain disorders must work in a similar region-based mechanism. Considering the direction where neuroscience research is headed, which is to dissect the role of every neuron and synapse in behavior, Sterling considers the view that psychiatric disorders can be treated by targeting one or more regions in the brain to be an outdated idea that inaccurately describes the way that the brain functions.

One of the greatest technical and ethical challenges facing DBS as well is its invasiveness, which not only stands as a barrier to its testing and application in the treatment of diseases, but also as a barrier for enhancement-related uses. However, recent developments suggest that DBS can be achieved in a non-invasive manner using what is known as a "temporal interference" strategy (Grossman et al., 2017).

The therapeutic possibilities for psychiatric and neurological disorders have expanded thanks to the development of DBS. Despite that, ethical and religious questions regarding its accountability, patients' personal identity, and feelings of authenticity are yet to be answered. In an effort to address these questions, Jawad Bajwa, Assistant Professor of Neurology at King Fahad Medical City in Saudi Arabia and expert consultant on DBS, provided insights about the ethical dilemma of DBS, and its future roles (Bajwa, personal communication, October 01, 2024). According to him, the ethical dilemma is mostly related to psychiatric disorders in terms of consent, understanding DBS procedure, and its outcomes. However, the use of DBS for non-psychiatric disorders such as neurological disorders does not have the same ethical burden it bears with psychiatric disorders. Because of studies that observed personality changes in association with DBS, Bajwa was asked if this effect was observed with his patients. In response to this, he stated that while there are changes observed in cognitive domains like verbal fluency, attention span, and memory which are mostly related to the disease itself not to DBS, in his own experience no personality changes were diagnosed and observed due to it. When asked whether or not patients refused surgery because of ethical and religious concerns, he responded that most of the time, patients don't refuse surgery, but if they do, it is usually related to fear of surgical interference but not to ethical and religious beliefs.

In terms of future roles of DBS, Bajwa elucidated that DBS is under investigational use for the treatment of obesity, OCD, depression, and other disorders, but it still needs remarkable research to understand the exact targets and long-term outcomes. Furthermore, he stated that DBS can only correct and improve pathological deficits and not improve existing physiological functions and mechanisms. Therefore, according to Bajwa, DBS cannot be used for human enhancement or enhancement of personal qualities. Furthermore, he predicted that no replacement for DBS to treat movement disorders will appear in the near future unless the diseases themselves are cured through other means because DBS is a symptomatic treatment, not a cure. However, in terms of device-based technology, there are techniques other than DBS that are being developed to improve or treat similar diseases, but they are all based on previous DBS successes. The science and the methodologies of these other techniques are similar to DBS, but the format and delivery are different. For example, one version of DBS is called adaptive DBS, which measures electrical changes that happen in certain regions of the brain and tailors the administered stimulation according to the changes in electrical signals measured from the brain. In a closing remark, Bajwa stated that,

> "the techniques may change, technology may get better, approaches may improve, become more safer, but the concept of deep brain stimulation will continue to evolve over the course of time. But again, the current DBS is not to be replaced, I think DBS will stay, but the format, process, technology, hardware, software will all continue to evolve and change." (Bajwa, 2024)

3.2. Potential Enhancement Uses of Deep Brain Stimulation

The invasiveness of the DBS technique has thus far limited the number of experiments testing its enhancement effects in human subjects. Nevertheless, there are some studies on humans that tested its cognitive enhancement effects. Furthermore, there is expanding interest in employing various types of brain stimulation for enhancing the performance of military personnel, such as increasing arousal, decreasing fear, and facilitating multitasking (Brunyé et al., 2020). This expanding military interest may progressively push the boundaries of DBS technology from therapy toward enhancement. In a recent study by Kostick-Quenet et al. (2022), 70% of the interviewed DBS experts answered that they believe adaptive DBS (explained in the previous section) may be used for enhancement. Indeed, there are a number of studies indicating that DBS may have enhancement effects. One of the earlier studies showcasing enhancement using DBS was done on a patient in whom it was tested as a treatment for morbid obesity. The study found that autobiographical memory was evoked as a result of DBS (Hamani et al., 2008). Another study showed that activation of one part of the brain, known as the entorhinal area, during learning can lead to the enhancement of memory (Suthana et al., 2012). Other similar studies also indicated that stimulation of brain regions and nerves that connect to the hippocampus, an area of the brain that is known for converting short-term memory to long-term memory, also leads to memory enhancement (Clark et al., 1999; Koubeissi et al., 2013; Suthana et al., 2015).

It is worth mentioning, however, that these studies were done in patients and not in healthy volunteers. So, it cannot be entirely excluded that the "enhancement" effects were seen mainly because they were performed on "diseased" brains. Scientists have in fact observed that the results of brain stimulation in general can depend on the baseline state of the brain before stimulation (Brittain et al., 2014). In addition, many researchers debate whether or not it is possible to enhance certain functions in the brain without incurring costs to other functions (Brem et al., 2014; Luber et al., 2014). This raises the question of whether generalized enhancement of cognition is possible.

The small number of studies on enhancement using DBS is noteworthy. However, there are many reasons why performing more enhancement studies using DBS can be ethically challenging. Enhancement trials performed in patients constitute an additional burden of experimentation that the patients are not obliged to bear as this is not the main reason that they undergo trials with DBS. It is also not known whether the potential added benefit of DBS can justify the additional burden undertaken by these patients (Ford et al., 2006). As resources are also quite limited, there is no justification for allocating valuable medical resources towards performing studies on enhancement as it can risk taking away funding from therapeutic studies (Ford et al., 2006).

Based on the positive evidence showing that DBS can be used for enhancement, it is believed that this will give rise to what Lipsman and Lozano named "cosmetic neurosurgery" (Lipsman & Lozano et al., 2015). Although ethical roadblocks slow down the progression of DBS from therapeutic uses to enhancement uses, it is nevertheless a real possibility, propelled forward by military interests and cognitive enhancement advocates like Elon Musk, founder of Neuralink Corp., a neurotechnology company, among others. Just as cosmetic surgery is now commonplace and even socially acceptable,

it can be expected that cosmetic neurosurgery might also become a service requested by healthy people invested in enhancing their own cognitive abilities and willing to bear the risks of this undertaking.

4. Legal and Ethical Challenges of Deep Brain Stimulation from an Islamic perspective

Engaging with the Islamic ethics of non-medical brain stimulation in general and non-medical deep brain stimulation, in particular, might seem like a futuristic problem or one that does not concern the Islamic world, many countries of which are low- and middle-income countries that do not yet have large-scale non-medical access to neurotechnologies. However, the European Union recently implemented two new regulations for non-invasive brain stimulation devices in the Medical Device Regulations (Bublitz et al., 2024), showcasing that the era of consumer-directed non-medical brain stimulation has already started.

Since the end of the 20th century, Islamic legal and religious scholars, (bio)ethicists, and some doctors have developed different approaches to evaluating medical ethical issues and Islamic-based principles for ethics in (bio)medicine. Contrary to what is often assumed, the approaches within the medical ethics discourse are not limited to those known from the field of Islamic jurisprudence (*fiqh*) or the principles of Islamic jurisprudence (*uṣūl al-fiqh*). Rather, the discourse is characterized by methodological diversity. "Islamic bioethics remains very much a field in and under construction" (Padela 2021, 3), claims Aasim I. Padela, pointing to the fact that players from different disciplines (inter)act in this field, bringing with them different motivations, training, and authority which leads to different approaches to challenges in biomedical research and healthcare. One of the approaches is based on the five essential higher objectives of Sharīʿah (*maqāṣid al-sharīʿah*), which names five essential objectives (*maqṣid*, pl. *maqāṣid*): religion (*dīn*), human life (*nafs*), progeny (*nasl*), material well-being (*māl*) and intellect (ʿ*aql*) in premodern literature, such as in the work of Abū Isḥāq al-Shāṭibī (d. 1388).

In today's world, *maqāṣid*-based models are more suitable than *fiqh*-based approaches because their flexibility allows them to be applied to new challenges. Consequently, according to Muslim theologians Serdar Kurnaz and Jameleddine Ben Abdeljelil, this approach is becoming increasingly popular in the face of medical and medical technology changes, but also in technology in general and in Islamic law today (Kurnaz, Ben Abdeljelil 2014, 136f).

4.1. Importance of Reason

There is a risk that DBS changes personality (see above). Previous studies have not yet been able to rule out a personality-altering effect and both positive and negative effects on personality are possible. According to psychologist Jens Asendorpf, personality is expressed in behavior, among other things (Asendorpf 2018, 8). Clear-mindedness for religious practices is required in Islam. The conscious performance or omission of actions is also essential in the Islamic faith, which is why, for example, substances that have consciousness-altering effects are not permitted. However, an emergency situation may turn a prohibited substance into a medication recommended under religious law, such as the use of certain analgesics to cause pain relief (Kellner 2020, 321).

4.1.1. Reason and Moral Responsibility

A clear state of mind is a prerequisite for the power of judgment. The mind is an essential prerequisite for the imposition of legal obligations and ethical responsibility, the so-called *taklīf* ('burdening'). God has created *taklīf* (Qurʾānic verses 6:152 and 7:42), and the extent

of the obligations depends on the individual's ability to understand and implement the legal and ethical requirements in the message of God. The jurist Nora Zeineddine makes it clear that the mind is the human characteristic to which Islamic law links responsibility before the law. However, it is more of an 'abstract concept' and cannot be perceived directly, which is why physical sexual maturity (*bulūgh*) replaces it as a measuring instrument (Zeineddine 2019, 62).

Muslim jurists, on the other hand, take into account that people are unable to fulfill the divine provisions due to physical and mental disabilities. This relief is based on a well-known saying of the Prophet Muḥammad:

> "The pen is lifted over three people: over the sleeping person until he wakes up, the madman until he gets well again, and the child until it can think." (Ibn Mājah 1918, Hadith Nr. 2041, 658)

An essential element of *taklīf* is that the *mukallif* (obligor) informs the *mukallaf* (obligee) of what is required of him to do or refrain from doing. A *mukallaf* recognizes this by means of his reason (Heemskerk 2000, 143). In order to enable a believer to fulfill his/her duties, his/her body and strength must be at his/her disposal according to the *taklīf* concept. Otherwise, it is contrary to divine justice to impose duties on someone who cannot fulfill them as the Qurʾān states that God does not require of any soul more than what he/she can bear (Qurʾānic verse 2:286). Therefore, people who lack mental and physical abilities are exempt from *taklīf* (*ghayr mukallafūn*).

Religious norms include the creed, ritual prayer, almsgiving, fasting, and the pilgrimage to Mecca, which fall under the God-human relationship. The believer will be held accountable by God in the afterlife. Legal norms relate to the relationship between people in this world; people are therefore penalized with sanctions in this world if they fail to comply (Rohe 2011, 10f). According to the Islamic narrative of the creation of mankind, humans are characterized by the fact that they take on the responsibility of acting on behalf of the divine creation. According to Muslim understanding, they are, therefore, the representatives (*khalīfa*) of God on earth. Man's special position within creation is explained by this vocation.

Personality changes can alter behavior and actions, such as religious duties, which may no longer be consciously performed or omitted. He/she can no longer use his/her reason to recognize what God has commanded or forbidden.

4.1.2. Reason and Legal Obligations

Reason is central to assessing the capacity to act in legal transactions, including personal matters such as marriage. Islamic legal literature therefore regulates the cases in which a person's actions are legally valid. Capacity to act (*ahlīyat al-adāʾ*) is linked to the ability to reason, which is why a rational person (*mukallaf*) enjoys this (Zeineddine 2019, 65f). On the other hand, every person enjoys legal capacity (*ahlīyat al-wujūb*) because he/she has the capacity of a human being to be the holder of rights and the bearer of duties, which includes both religious and legal norms (Faridzadeh 2016, 360–365). In principle, the people's legal capacity and capacity to act in Islam is differentiated according to their stage of development (Dols 1992, 435–455). In Islamic law literature, the legal autonomy of people with impaired judgement is discussed under the heading of 'restriction of legal capacity' (*ḥajr*). The Islamic scholar Oussama Arabi defines *ḥajr* as the 'judicial denial of the ability to dispose freely of one's wealth' (Arabi 2000, 300). The relevant areas of the person affected by the business restriction (*maḥjūr ʿalayh*) include taxation, marriage, divorce, inheritance, contracts and religious obligations. Concern for the objective

interests of a person with an intellectual disability would therefore limit their legal capacity, argues the Ḥanafī Islamic legal scholar al-Sarakhsī (d. 1090).

Accordingly, it should be ensured that the mind is clear in order to bear theological and moral responsibility before God as well as to be able to effectively carry out interpersonal affairs by means of the ability to act in accordance with Islamic law.

4.2. Evaluation of Deep Brain Stimulation from an Islamic Ethical View

In the following section, an assessment of DBS from an Islamic ethical perspective will be undertaken using the principle of avoiding harm and promoting benefit (*istiṣlāḥ*). The first consideration is based on the assessment of potential harm to the individual regarding the personal responsibility and the risk of misuse. The second consideration will deal the question of justice due to limited accessibility. The topic of necessity will be discussed by evaluating unpredictable side-effects for the long term.

4.2.1. Personal Responsibility at Risk

On one hand, DBS can be used medically to alleviate the symptoms of an illness. On the other hand, DBS can be used for potential enhancement to increase physical and/or mental performance. The benefits are contrasted by potential harm: personality change and unpredictable long-term harm. There is a potential risk of personality change with DBS. Can a potential risk justify a benefit from the use of DBS? Despite the risk of medical use, DBS could be accepted if the benefit is demonstrably greater. Yet the aim is not to cure the disease but to alleviate symptoms, which can lead to an improvement in quality of life. It is, therefore, questionable whether the risk should be accepted in view of the possible negative effects. It would be justified or permissible if a cure were possible through the use of DBS. As this is not (yet) possible, it is therefore advisable not to use DBS. Still, this does not justify accepting incalculable harm. The use of DBS should not be recommended if a change in personality is accepted for potential enhancement uses. This is a performance enhancement that does not necessarily bring with it any substantial health benefits.

Furthermore, the studies investigating the long-term side effects of DBS are still limited in number (Olson et al., 2023; Jung et al., 2022). Should DBS be performed for symptom control despite unpredictable side effects? A harm-benefit analysis is used to assess whether the therapy is appropriate in view of the potential risks. As previously discussed, DBS only treats the symptoms of a disease. Similar to the assessment of potential harm to the person, the use of DBS should also be rejected in this case, as it is not possible to foresee the risks involved or the extent of these risks. For this reason, in particular, DBS should not be used if it is only carried out for potential enhancement use.

A counterargument could be that any 'harmless' side effects that occur are effectively treated, which further relativizes the scope of this argument. This argument can be dismissed as it remains unclear which specific risks are actually to be feared. Without specific evidence of serious side effects, the discussion remains purely speculative.

Furthermore, it could be countered that drug addiction impairs judgment. Since DBS has shown initial success in reducing substance abuse (Chang et al., 2022), the use of DBS could restore the decision-making ability of drug addicts, which would justify its use. This argument can also be refuted, as alternative measures without surgical intervention and potential personality changes exist to treat drug addiction.

4.2.2. Risk of Misuse

A frequently discussed risk is the potential misuse of medical treatments for purposes that go beyond the actual indication, for example for performance enhancement. This risk is

increased if doctors receive financial incentives to promote such applications, even if they are not medically justified. However, it should be noted that such a risk cannot be completely ruled out for many medical procedures. It therefore requires strict regulations and ethical guidelines to minimize such developments.

Another scenario of misuse concerns the manipulation of technologies, such as brain pacemakers, to unintentionally or intentionally stimulate other regions of the brain. Such interventions could have potentially unpredictable and undesirable effects on brain function. This emphasizes the need for comprehensive safety precautions, precise medical indications, and a clear limitation of use to controlled therapeutic contexts.

4.2.3. Limited Availability as a Problem of Justice

Both the scarcity of resources and the financial burden are further decisive factors for the acceptance of DBS for medical uses. The limited access to DBS for the majority of patients who could benefit from DBS raises the question of distributive justice. The same argument could be made for the availability of intensive care equipment, such as ventilators. In contrast to DBS, ventilators can save or prolong life. In view of the improvement in quality of life, it could be argued that only a few people could benefit from this. However, government funds should be used specifically to cure the underlying disease rather than to treat the symptoms.

4.2.4. Question of Necessity for Medical and Potential Enhancement Uses

According to the principle of necessity (*ḍarūra*), something that is generally prohibited can be considered permissible or mandatory in an exceptional situation. Exceptional situations are cases in which life is endangered and the consumption of a forbidden substance would save life. For example, the consumption of pork in a life-threatening situation is permitted or obligatory in order to save one's life (Ilkilic 2002, 83). The danger to life makes it necessary to break a ban.

In the following, it will be discussed whether the severity of the illness of the patient groups that would benefit from medical use of DBS constitutes an exceptional situation that would allow the potential risks to responsibility and health to be accepted. For this reason, DBS is questionable, as DBS involves a surgical procedure that is not always medically necessary.

The patient group is people who suffer from Parkinson's disease, for example. If Parkinson's disease would lead to death, this can be considered an exceptional situation. However, the use of DBS would only be justified if it cured the disease. Therefore, the *ḍarūra* principle cannot be applied here. However, there is advocacy to accept DBS for medical use as the following interviews with Islamic scholars show.

4.3. Islamic Legal Views on Deep Brain Stimulation

There is a significant lack of research discussing DBS from an Islamic perspective, indicating the need for scholarly engagement to address its ethical concerns in the framework of Islamic teachings. Therefore, Mohammed Eldomy, Islamic scholar and the imam of Mostafa Mahmoud Mosque in Giza (Egypt), was approached by the authors to address the ethical, religious, and social implications of DBS (Eldomy, 2024). Eldomy answered that surgery ought to be considered as a last resort. If the illness does not necessitate surgery and alternatives exist, it should not be undertaken, otherwise, surgery is justified, as narrated Jābir ibn ʿAbd Allāh:

> "I heard the Prophet saying, 'If there is any good in your medicines, then it is in a gulp of honey, a cupping operation, or branding (cauterization), but I do not like to be (cauterized) branded.'" (Sahih al-Bukhari Book 76, Hadith 22)

The rather negative attitude towards a surgical procedure such as cauterization is transferred to DBS. From a legal, ethical, and medical perspective, alternatives to surgery should be considered preferable. Eldomy then added that in case surgical intervention is deemed necessary, professional ethics must be strictly adhered to, which includes ensuring the patient's informed consent, and being fully aware of any available alternatives and all potential risks for them to make a decision free of deception, coercion, or manipulation. Additionally, as with any medical procedure, DBS must be tested on non-human test subjects first before being used on humans. Following these tests, recognized medical and pharmaceutical bodies must give approval, to ensure its safety for human treatment rather than for purposes of control. Another point he added, is that provided no alternatives exist, DBS should only be used as a treatment for medical conditions, even if it has side effects, it should never be used for controlling, altering or distorting a person's mind and behavior such as through the implantation of chips for the purpose of mind control or enforcing uniform traits. Such practices are categorically prohibited from a moral and religious standpoint. Finally, Eldomy emphasized that personality changes resulting from DBS should be considered as potential side effects such as negative and positive changes that are potentially caused by DBS in Parkinson's disease (Eldomy, 2024).

Eldomy's statement is concise but takes into account the risks of DBS and emphasizes the conditions for its therapeutic use. He clearly rejects targeted personality change for the purpose of mind control. Overall, his attitude towards DBS is rather positive. To analyze other Islamic legal aspects of DBS, the authors interviewed Sheikh Mostafa Ahmed Thabet, Sharīʿah scholar and the director of the Sou'al Initiative at Tabah Foundation in Egypt. The brain stimulation purposes and methodology, both non-invasive and invasive (DBS) were explained in detail to Thabet. It was also explained that stimulation is currently used for therapeutic purposes and might also be utilized for enhancement purposes in the future. In response to the question on the Islamic legal position of brain stimulation, Thabet clarified that:

> "Sharīʿah has permitted and favored 'tadawi' (the seeking of medical treatment or cure) as the prophet, peace and blessings be upon him (PBUH) is known to have said that, 'Allah has sent down both the disease and the cure, and He has appointed a cure for every disease, so treat yourselves medically, but use nothing unlawful.'" (Sunan Abi Dawud, Book 29, Hadith 20). (Thabet, 2024)

The meaning of using nothing unlawful is that one should not use what Allah has prohibited including what is *ḥarām* (prohibited) or *najis* (ritually unclean) in case that the *ḥalāl* treatment is not available or in case there is no *ḍarūra*. But, Sharīʿah has allowed the use of a forbidden treatment in case that *ḍarūra* dictates that the person must be treated with it (see above).

Thabet then concluded that a treatment for an ailment would be *mubāḥ* (permissible), if (1) it does not carry a danger for a person's life, (2) its harms were not greater than its benefits, and (3) it was carried out under the supervision of a physician known among his professional peers for his extensive knowledge and competence.

Regarding the use of brain stimulation for enhancement purposes, Thabet stated that,

> "There are two aspects that must be considered for [Islamically] evaluating the enhancement uses of brain stimulation: (1) the Sharīʿah's ruling on these devices and their use for cognitive enhancement, and (2) the consequences of the widespread use of brain stimulation devices in the near future or further ahead. This is crucial because it may seem initially that the use of these devices is *mubāḥ*, but its use can lead a person to do what is *muharram* (forbidden/prohibited). In Islam, reaching something that is prohibited through what is permissible often leads to prohibition of what was considered permissible. This is known as the principle of *sadd al-dharāʾyi*."

Thabet clarified that the actions considered as *dharāʾiy al-fasād* or "means to evil" are generally divided into three different types as explained by Imam Al-Qarafi:

> (1) Actions that the *ummah* (Islamic community) has unanimously considered to be a means to evil as it is known with certainty to lead to evil. Without any doubt, these actions are prohibited. Example actions in this category include selling weapons to a transgressor and digging in the public roads without providing warning to the pedestrians and drivers.
>
> (2) What the *ummah* has unanimously agreed not to prohibit despite the risk of dual use. For example, planting grapes was never forbidden in the history of Islamic jurisprudence although grapes can be used as means of producing wine. Similarly, the flying of planes or sailing of ships were also never prohibited in Islamic jurisprudence despite the existence of a certain risk of crashing or drowning. However, the risks are not greater than the benefits, so they do not constitute a reason for prohibition.
>
> (3) What the *ummah* has debated whether it should be blocked as a means to evil. Although actions in this category can often lead to corruption, this does not happen predominantly. For example, according to the Mālikī legal school, postponing the payment of dowry is *makrūḥ* (discouraged), because people may use it as an excuse to marry without a dowry.

Looking through this lens at the issue of cognitive enhancement per se, Thabet highlighted that, in principle, there is no problem with a person seeking to augment their bodily or cognitive abilities as there has been no text in Qurʾān, Sunnah or scholarly consensus that stated that this is a prohibited or discouraged endeavor. Quite to the contrary, prophet Muḥammad is known to have encouraged people to be keen on what benefits them (Muslim, Book 16, Hadith 90). The concept of benefit (*maṣlaḥa*) in Islam is defined as what is considered to be beneficial for both a person's *dunya* (life) and *ākhira* (afterlife). It is with certainty, Thabet asserts, that augmenting a person's bodily capabilities, boosting his/her intelligence, or strengthening his/her memory are not only beneficial for his/her own life, but also for his/her community, nation, and the entire *ummah*.

On the issue of whether brain stimulation devices and procedures are to be considered as changes to Allah's creation, Thabet commented that,

> "They would not be considered as changes to Allah's creation, because there is a difference between boosting the performance of existing organs or functions in the body and adding an organ or a function that did not previously exist. And there is no doubt that Sharīʿah has encouraged performing sports, for the Prophet Muhammad (PBUH) is reported to have said, "Teach your children swimming and archery." (Narrated by Imam Bayhaqi in "Shu'ab al-Iman"). It was also narrated by Abdullah ibn Umar that, 'Allah's Messenger (PBUH) ordered for a horse race; the trained horses were to run from a place called Al-Hafya' to Thaniyat Al-Wada` and the horses which were not trained were to run from Al-Thaniya to the Masjid (mosque of) Bani Zuraiq. The subnarrator added: Ibn `Umar was one of those who took part in the race.' (Sahih Al-Bukhari, Book 8, Hadith 70)."

Thabet also remarked that the prophet Muḥammad has said,

> "Practice archery and practice riding, and the you should practice archery is more beloved to me than that you should ride. All idle pastimes that the Muslim man engages in are falsehood, except for his shooting of his bow, his training of his horse, and his playing with his wife, for they are from truth." (Jami' al-Tirmidhi, Book 22, Hadith 19).

Thabet concludes that,

> "Based on this analysis, anything which can be used for the strengthening of the body and stimulating the mind is permissible and may even be favorable if it used

> for purposes that Sharīʿah deems favorable, such as fulfilling rights, providing help to those in need, or performing *jihād* against transgressors. In fact, it is established in *uṣūl al-fiqh* that means get the same ruling as the ends. Therefore, if the purpose of brain stimulation is the sharpening of attention, strengthening of memory, or speeding up a person's reflex responses so as to prevent harm or confer enhanced capabilities, then brain stimulation is permissible. This permissibility is not to be affected by the risk of misuse such as the risk of using these devices for mind control or employing the enhanced cognition for harmful purposes. This is in line with the scholarly view that if an action is not prohibited in itself, then it is permissible in itself."

When asked regarding the potential ethical repercussions of brain stimulation, such as the social justice concerns and concerns over loss of personal autonomy, Thabet answered that these concerns do not constitute *dharāʾiy* that must be blocked, as there are activities that are permissible in themselves, but prohibited only when they are used for harmful purposes. Examples of such activities in the modern world include the internet, mobile phones, and weapons.

For the sake of controlling harmful uses, Thabet called for nations and governments to establish legal and ethical frameworks for the use of brain stimulation technologies to prevent the harm of these technologies from reaching poor societies and to prevent their misuse by the companies that produce them. He also recommended the establishment of laws that regulate their use on individuals and ensure that the use of these devices does not become widespread in a way that harms humans. Thabet explained that,

> "In Islamic jurisprudence, the ruler and *wali al-amr* (the person in authority) have the license to restrict what is permissible if they find that such prohibition or restriction is in the interest of the people. This view does not contradict with what we have mentioned before regarding the inherent permissibility of the technology."

In the final remarks, Thabet concluded that, deep brain stimulation is Islamically permissible but under the following conditions: (1) it must be done with the knowledge and under the supervision of a physician, (2) it must be completely safe such that no harm should happen to the user as a consequence of using this technology, such as increasing the risk of stroke, paralysis, or cancer, and (3) it must be completely legal to use this technology in the country where the person resides, as legislative bodies are entitled to apply restrictions to permissible actions if they observe this to be in the people's best interest (Thabet, 2024).

In contrast to Eldomy, Thabet goes into more detail and also mentions conditions for medical use, such as the fact that DBS must not promote serious illnesses. He draws a controversial comparison between DBS and sport by equating cognitive performance enhancement through DBS with physical performance enhancement through sport. He does not consider the potentially personality-altering effect of DBS to be a reason for a general rejection. Overall, Thabet has a very positive attitude towards DBS.

To summarize, neither Eldomy nor Thabet address the potential impairment of moral and legal responsibility due to the personality-altering effects of DBS. Both advocate the use of the therapy for medical purposes, although DBS has so far been used exclusively for symptom control. Thabet goes one step further and supports the use of DBS for enhancement purposes. In doing so, he draws a controversial comparison that ultimately justifies an intervention in the human body that is not medically necessary, solely to improve mental performance.

5. Conclusions

Deep brain stimulation (DBS) is a controversial approach from an Islamic ethical and legal perspective. From an ethical perspective, DBS is viewed critically, as it can potentially cause harm that is not offset by sufficient health benefits.

The legal perspective, represented by the Islamic legal scholars Eldomy and Thabet, shows concern about the possibility of mind control but does not address the potential impairments of moral and legal responsibility (concepts of *taklīf* and *ahlīyat al-adāʾ*) that could result from the personality-altering effects of DBS. Both legal scholars advocate the use of the therapy for medical purposes, although DBS has so far only been used for symptom control. Thabet even advocates the use of DBS for enhancement purposes. He draws a controversial comparison between physical performance enhancement through sport and cognitive improvement through DBS. This argument leads to a questionable support of a medically unnecessary intervention in the human body, solely to increase mental performance.

The question of necessity (*ḍarūra*) is answered differently from an Islamic perspective. The legal scholars are in favor of DBS if the medical professional considers it necessary. Only the treatment of the disease can be medically necessary. As the *ḍarūra* principle does not apply in this case, a harm-benefit assessment (*istiṣlāḥ*) has proven to be expedient from an Islamic ethical perspective: The potential harms were considered and set against the benefits of symptomatic treatment. The fact that DBS may cause potential harm suggests that the unpredictable threat to health and moral responsibility outweighs the benefit of DBS.

Further research that enables the elimination of harm may change the ethical evaluation because the benefit of improving life quality can be a legitimate reason for the use of DBS. The principle-based approach in Islamic bioethics allows to systematically analyze the harms and benefits within an Islamic framework. As the field of neuroscience raises further ethical questions, there is a growing need to answer them from different viewpoints that also include religious and cultural views. This paper aimed to identify ethical challenges in the medical use of DBS including Islamic bioethics principles. These exist in a similar form in secular bioethics and can be applied accordingly.

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