

Ethical Concepts and Future Challenges of Neuroimaging: An Islamic Perspective

Wael K. Al-Delaimy

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Abstract Neuroscience is advancing at a rapid pace, with new technologies and approaches that are creating ethical challenges not easily addressed by current ethical frameworks and guidelines. One fascinating technology is neuroimaging, especially functional Magnetic Resonance Imaging (fMRI). Although still in its infancy, fMRI is breaking new ground in neuroscience, potentially offering increased understanding of brain function. Different populations and faith traditions will likely have different reactions to these new technologies and the ethical challenges they bring with them. Muslims are approximately one-fifth of world population and they have a specific and highly regulated ethical and moral code, which helps them deal with scientific advances and decision making processes in an Islamically ethical manner. From this ethical perspective, in light of the relevant tenets of Islam, neuroimaging poses various challenges. The privacy of spirituality and the thought process, the requirement to put community interest before individual interest, and emphasis on conscious confession in legal situations are Islamic concepts that can pose a challenge for the use of something intrusive such as an fMRI. Muslim moral concepts such as *There shall be no harm inflicted or reciprocated in Islam* and *Necessities overrule prohibitions* are some of the criteria that might appropriately be used to guide advancing neuroscience. Neuroscientists should be particularly prudent and well prepared in implementing neuroscience advances that are breaking new scientific and ethical ground. Neuroscientists should also be prepared to assist in setting the ethical frameworks in place in advance of what might be perceived as runaway applications of technology.

Keywords Islam · Ethics · Neuroethics · Neuroscience · Neuroimaging

W. K. Al-Delaimy (✉)
Department of Family and Preventive Medicine, University of California, La Jolla, San Diego, CA
92093-0628, USA
e-mail: waldelaimy@ucsd.edu

Introduction

Advances in neuroscience, and specifically functional Magnetic Resonance Imaging (fMRI), offer the potential for major breakthroughs in understanding the pathology of neurological and mental diseases. Appropriately used, this is likely to have a positive impact on preventing and treating Alzheimer's disease, dementia, bipolar disorders, and other mental and behavioral disorders.

fMRI proves a useful example in considering some of the ethical implications of new developments in neuroscience. It has already been used to identify localized brain and cognitive activities associated with particular mental and spiritual states of mind (Beauregard and Paquette 2006). This new domain of investigation raises numerous ethical, legal and social challenges. How would data produced from fMRI be used? How might such a technology be applied and who would be screened? How would mentally compromised individuals be consented? Where is the boundary between acceptable and unacceptable use of such intrusive instruments? Can this lead to further discrimination and disparity based on neurologic/mental categorization of gender, age, race and ethnicity, or socioeconomic status? Who is driving this science, who are the end users, where is it being marketed? All of these concerns and more lie in the discipline of neuroethics, defined by some as the bioethics of the brain (Illes et al. 2003).

Neither science nor technological innovation can be completely controlled and are usually driven by many factors including the enthusiasm of a scientist, industrial funding, and the needs of end users. However, when scientific developments cross into new dimensions of one's understanding of the world, society is challenged to develop relevant ethical frameworks. Science has advanced the understanding of the physiological and anatomical attributes of the human brain, but much more remains to be done to explain differences in personality, psychology and human behaviors and actions. Cognitive behavior, emotions, thought process and many other non-physical functions of the brain are expected to be linked to the 100 billion nerve cells in the brain (Hamame et al. 2011; Mileykovskiy and Morales 2011), although the relationship between mental activity and brain activity has yet to be fully determined.

Western secular philosophy can direct ethical questions to standard ethical concepts of autonomy, beneficence, nonmaleficence, and justice, but other traditional non-Western populations may require evaluations of ethical questions from the specific contexts of their faith and culture (Voo 2009). The religion of Islam with more than 1.3 billion followers worldwide is the second largest after Christianity and a unique global subpopulation. New intrusive technologies or instrumentation such as fMRI are likely to have ethical and religious implications for this large percentage of the world population because such technologies may also offer insight into the process of consciousness, spirituality and thought.

The Thought Process

The thought process is too complex to ascribe to a single neuron or part of the brain. Cognition is a fluid state engaging different parts of the brain, as shown by the

different cognitive function tests for each function in different parts of the brain, using different neurological centers and areas of the cerebrum to develop a thought or intention of an action (Robertson et al. 2000). As shown by Beauregard and Paquette (2006) in their study of meditation among nuns, the brain foci correlates of their meditation included many regions on both sides of the cerebral cortex and brainstem nuclei.

The transience of ideas, bad and good, are an everyday occurrence. They can be likened to a rushing river, spilling out into many streams, which then feed back into the river, all contained in a volume the size of the human skull. Ideas can briefly focus and then disperse again or be re-shaped and involve a different part of the brain. This process both defines and influences emotions, behaviors and physiological state.

Attempts to better understand someone's thoughts, feelings and experiences through advanced neuroimaging technology are likely to continue and to increase in success. One such example is the differentiation of a highly spiritual state of mind and thought (Beauregard and Paquette 2006). Is this captured image a temporary representation of a thought or an emotional state? Was it going to transform into action? Was it just something from a past memory? Thoughts, beliefs, feelings, emotions and personality traits are not fixed; what is the firm belief of someone today can be transformed into something of the past at a later day. How can this belief be characterized or linked to an individual? It is not a gene on a chromosome, nor a pathological condition identified in the tissue of a certain organ.

There are additional factors that may confound results. If a person knows that someone is trying to capture their emotions and thought processes, would those thoughts change, either intentionally or unintentionally? Would the instant in which an image is captured uniquely map to a single event or instead reflect only some passing phenomenon relevant to an unrelated past experience? Although the science of neuroimaging is evolving and might one day be able to transcribe thoughts into an image or written form, the meaning of such data might be too elusive for objective and scientific purposes. More importantly, the neuroimaging of thoughts raises serious questions about privacy and confidentiality for patients or study subjects. Would the technique cause more harm than good?

The Privacy of the Thought Process in Islam

In Islam, thoughts are private between the person and God. The spiritual relationship is directly between a person and God, not through a third party or object, nor limited to a certain place or status. Conscious thoughts are known only to God: *Lo! He knoweth that which is said openly, and that which ye conceal*, Holy Quran 21:110 (Yusuf Ali 2010). No other human is expected to know about the thoughts of another individual that are not expressed through physical, written, spoken, or other explicit form. Such private thoughts are considered a sacred entity to be protected. Given that in Islam people are prohibited to even peek inside someone's house without permission, the idea of taking a peek inside someone's mind and thoughts is crossing a much higher Islamic prohibition. As discussed

below, granting permission for an outsider to intrude into one's thoughts is not always an individual's decision. The privacy of thought carries an even larger ethical context: the inner and spiritual consciousness is a judge of one's actions, but it is also a persuasive power to carry out evil deeds. The prophet says *Whatever you think about but are afraid people will know about it, means that it is wrong* (Al-Nawawi 1999).

Islam teaches its followers that they can modify their own thoughts and beliefs, as well as those of others, by arguing, and discussing in a legitimate and acceptable manner. Some thoughts will dissipate, and others will circulate back and forth, still others will become an intention and then materialize into action. Therefore, although discouraged against unacceptable or evil thoughts, Muslims are not held to account for bad thoughts. Until that thought materializes into speech or action, there are no limitations. Muslims are not restricted in when to stop a thought from developing or trying to categorize whether a certain thought is a sin or not. It is the action, not the thought, that counts for or against a person from the Islamic perspective. The teaching of the prophet says: *If you think of an evil thought or intention to do something but then reverse that thought and do not take action on it, you get rewarded for it by God* (Al-Nawawi 1999). However, continuing to think evil is likely to translate into evil action according to the teachings of Islam. In the Quran there is also a warning that God is watchful and knows what you are hiding in your mind, for example, evil thoughts or intentions (Yusuf Ali 2010). The law and judges can make rulings about that person if the thoughts manifest in some form of action. In Islam, there is no prosecution for thoughts or intention. If neuroimaging enabled the categorization of individuals based on their presumed intention as determined by attributing or localizing thoughts to a certain region in the brain, would that be Islamically acceptable? Would this capability change the juristic fact that Muslims can only judge their fellow humans or Muslims based on their actions because they do not know their thoughts or intentions? The answer is not obvious but there are existing mechanisms in Islamic thought and moral code discussed in this paper that can provide guidance for researchers and Islamic jurists.

Spirituality and Science in Islam

Like almost all religions, spirituality is a foundation for the religion of Islam. There is a clear separation between spiritual and physical components of worship in Islam. The five pillars of worship (testifying there is no God but God and Mohamed is his Prophet, prayer, charity, pilgrimage, and fasting) all have both physical and spiritual components. The faith of Islam involves worship on a daily, weekly, monthly, yearly and lifetime basis with the aim of improving spirituality and strengthening belief.

Spirituality in Islam is a complex intertwined concept involving consciousness, thoughts, logic and the supernatural. It is related to the degree of one's faith and belief. The stronger the faith, the higher the spiritual status of a Muslim. However, this level of faith and spirituality is determined and known only by God. For Muslims, they can only observe some signs of higher faith and spirituality such as

being a good worshiper and a good human and other signs of *Eeman* (firm belief) as described in the teachings of Islam. Only God knows what goes on inside minds and how faithful and spiritual a person is. There are detailed classifications in Islam on the spiritual aspect of a human that include *RooH* (soul), *Qalb* (spiritual consciousness), *Nafs* (inner consciousness), *Aql* (mind) and further subclassifications beyond the scope of this paper. These metaphysical concepts are believed to be physically located in the body, in specific regions of the heart or brain, though there is no consensus by Muslim scholars on these issues.

The spiritual, unseen, and ultimate power of God is core to the creed of Islam. The concept that science holds all the answers to the universe and existence is inconsistent with this core belief. However, science and learning are inextricably intertwined with the history of Islamic culture. Muslims are responsible for fundamental contributions to algebra, medicine, chemistry and physics (Hassani and Woodcock 2008). The first word revealed to the prophet was an order to “Read”, and the word “think” is mentioned in the Quran when Muslims are required to think about God’s creation (Yusuf Ali 2010). This includes thinking about the human body and learning about its sophistication as evidence of His creation. Muslims are also asked to seek any treatment that science provides. The Prophet declared that for every illness there is a treatment that might not yet be discovered. Muslims are expected to actively seek this medical treatment through science and technology. Therefore, Muslims believe in cause and effect and the logical and rational explanations of phenomena whether illness or other.

The Moral and Juristic Code in Islam

The two sources of Islam’s teaching are the *Quran*; the holy book revealed by God to the prophet Mohamed during his life, and the *Sunnah*; the teaching in words and action of the prophet to his followers. Muslims rely first on direct or indirect text from the Quran, second on teachings of the prophet, and third on Muslim Jurists according to Islamic juristic criteria of *Ijtihad* (scholarly interpretation based on *Qiyas* [comparison], *Maslaha* [benefit], *Isthsan* [overruling] and other basic tenets of Islamic Jurisdiction and Sharia Law), or *Ijmaa* (Consensus) (Sachedina 2005). For major and common or recurring ethical challenges to the Islamic moral code, this process is carried out through the International Islamic Juristic Council, which includes learned scholars of Islam and science assessing the current needs in light of the spirit and understanding of Islamic jurisdiction (Sachedina 2005). The council was formed by the Organization of Islamic Countries.

Modern day issues are approached with the participation of scientific and medical experts to help religious scholars make decisions within an Islamic juristic framework and based on factual scientific data. This framework is neither final nor obligatory and can be debated in light of new evidence and technology. The above protocol is likely to be followed in the case of future neuroimaging uses and advances.

In Islam, whenever the benefits outweigh the harms, that path should be followed. For medical reasons, many things that are not allowable in Islam become

allowable based on another juristic law that states *Necessities overrule prohibitions*. For example, the pig is an animal that is considered impure in Islam and cannot be eaten nor any of its parts used. However, in the absence of a viable alternative, millions of Muslims have used insulin from pigs' pancreases to treat their diabetes. This is based on the concept of *sanctity of life* (Qureshi 2002; Yusuf Ali 2010). As a hypothetical example, if an epileptic patient requires daily medication, the effect of which can be altered by fasting (a major and obligatory pillar of worship in Islam), it becomes unacceptable to fast because it is known that the seizures that might occur from disrupting the medication could harm the patient or those around him, and harming one's self knowingly or intentionally is not allowed in Islam.

The Islamic moral code relevant to a new development such as the use of fMRI can be based on several principles (Sachedina 2009). The first Islamic principle, *There shall be no harm inflicted or reciprocated in Islam*, is similar to universal moral principles. The second relevant principle is that *Necessity overrules prohibitions*. The third principle is a feature of Islamic communitarian ethics, in the form of "consultation" known in Islam as *shura*. There is also another important concept based on the free will given to humans as described in the Quran: *No compulsion is there in religion, rectitude has become clear from error*, Holy Quran 2:256 (Yusuf Ali 2010; Vroom and Gort 1997). There are many other principles that might be applied but these are the most appropriate to help resolve boundaries for the use of fMRI. Beneficence and nonmaleficence (as demonstrated by weighing the harm versus benefit of fMRI), autonomy and the free will to choose, and justice for all in the community are widely accepted principles of human subjects research, and are all also incorporated in the Islamic belief and moral and juristic system.

If advanced neuroimaging were to become widely available, it should be used to serve humanity and the well being of those needing it. Everything in Islam should be weighed for harm versus benefit through checks and balances and according to a well-defined moral and ethical system. Community benefit is always a priority over individual benefit. As opposed to the ethics that emphasize individual autonomy in Western ethical thought, in Islam a "communitarian ethics" considers the consequence of decisions not only for the individual, but for the family and community resources (Sachedina 2009). That is why there is relative consensus among Islamic jurists about end of life decisions, stem cell use for research, organ donation and organ transplant. Muslims have a protocol to reach decisions that takes into consideration individual, community, and all other stakeholders in light of existing Islamic juristic foundations. Decisions are made based on meticulous analysis of factors that determine the rightness or wrongness of the case under consideration (Sachedina 2009). That is how the boundaries are drawn in Islam for any new phenomenon or scientific or medical invention that influences Muslims.

Applying the Islamic Code to fMRI Use

To demonstrate the above concepts, consider, for example, that a mentally disabled Muslim needs the use of fMRI to help him in his treatment; according to Islam, his family will be obligated to consent to the procedure if his consciousness is such that

he lacks capacity to be accountable for his own actions. Even if privacy of thoughts of the mentally disabled Muslim would be compromised by the use of fMRI, necessity overrides the prohibition. Guided by the Islamic communitarian code, it is in the interest of the community to alleviate the medical condition, and consultation by the family members or community is likely to support the procedure. If, on the other hand, fMRI were to be used to screen healthy people to decipher their thoughts and intrude on their privacy—either for the purpose of developing the methodology or exploring some vague research hypothesis—this would conflict with the Islamic moral principle that *there shall be no harm inflicted or reciprocated in Islam*. Muslims could of course give consent individually. Generally, there is no community or religious oversight for such consent *unless* it were to conflict with the communitarian ethical code (i.e. the individual's act must not infringe on the community or someone else's rights).

If the aim of a research study is to use fMRI to screen populations rather than individuals, additional ethical concepts come into play for Muslims. Involving large scale population studies would have ramifications beyond those of individual consent. Religious scholars of the community, locality, or country would need to be involved in the decision-making process at an early stage of the research project. This could require the input and involvement of the International Juristic Council if the matter were not resolvable within the individual country.

If an fMRI study were designed to compare different people of different religious traditions, including Muslims, more complex ethical considerations would be at stake. In addition to the above process of religious scholarly involvement, local or independent scientists (potentially from the Muslim faith) would need to provide an assessment of the scientific merit of doing such a study. Issues of concern might include the risk of stigmatizing or discriminating against followers of a particular faith. This is similar to current processes involving end of life decisions for Muslims where religious scholars delegate the decision making to Muslim doctor specialists who can assess the scientific merits of withholding life support. Ultimately, the decision to support such ethically challenging research will depend on the specific research question, data ownership, and the potential for misuse or abuse of data beyond the proposed research. This approach is also in general agreement with standard ethical considerations for research involving identifiable data of an individual, but with the difference that this will be an identifiable faith community, which will reveal confidential data from the perspective of this community.

Futuristic Neuroscience Applications and Islam

In its current state, it is hard to argue that fMRI technology might infringe on the ethical code of Muslims. It may be that this technology will never achieve the goals of reliable and accurate detection of behaviors like deception, for example. Nevertheless, it is important to ask at an early stage if such advancement in neuroimaging might be inconsistent with Islamic practices and belief.

From an Islamic perspective, such far-fetched technology would warrant *Ijtihad* (scholarly juristic invention) in which religious scholars would decide whether such

data could be used. Under the scholarly juristic perspective of *Istihsan* (to approve a new law in order to avoid distress), a basic moral code of Islam derived from the teaching of the Prophet is: *There shall be no harm inflicted or reciprocated in Islam* (Vroom and Gort 1997). The ultimate goal in setting these boundaries is to judge what to support based on potential consequences.

If in some futuristic application someone needs neuroimaging data for detection of individuals with criminal tendencies in the general population, for example, it might contradict the basic juristic rule of Islam (as well as other humanitarian concepts) that an accused is innocent until proven guilty. In Islam, a confession, being caught in the act, or having more than one witness testify to having seen the act committed is needed to convict a person. If fMRI were to provide an alternative to a conscious confession, such technology is unlikely to be allowed in Islamic rulings. An Islamic confession must come out of free will knowing the consequences, not through bypassing that free will, nor through coercion or torture. If a perpetrator does not willingly confess, and witnesses are not available, punishment is not permitted under Islam. Confession of a crime in Islam cleanses that sin by being served the punishment in this life. A Muslim is told if the crime is not accounted for in this life by punishment (and God does not forgive that person), that person will receive that punishment on judgment day. Therefore, the emphasis is on a conscious decision to accept the punishment, rather than on information obtained through neuroimaging or intrusion into someone's thought processes.

Beyond fMRI, advances in neuroscience that involve intervention have further consequences. An important issue for Muslims is that the whole creation of God is in a delicate balance. When one considers the human body, there is a complex balancing among many different chemicals and signaling pathways. Changing a single element has ramifications for changes in many. Similarly, if neuroscientists succeed in developing technologies to alter consciousness or memory through surgery, implants or psychopharmaceuticals, then they will unavoidably disturb the balance of other components in the brain with unknown consequences. Futuristic ideas of increasing memory, or creating "memories" that can never be erased, creates new problems. For instance, how will individuals be able to overcome grief if they cannot forget? Or what would be the consequences of eradicating, through neurological or pharmacological manipulation, negative attributes such as fear (Graham et al. 2011), which God created for a reason (as a protection mechanism and as a consequence of doing wrong). If one has no fear, then the judgments and decisions made can become inappropriate or dangerous because of lack of fear of consequences of such decisions, and for a Muslim this would even lead to lack of fear from God, a basic tenant of Islam. Thinking through these issues for fMRI is likely to be useful when considering other neuroscientific techniques and findings that raise significant ethical challenges.

Concluding Remarks

Understanding neuroscience and assessing its ethical implications in the context of the major religions is an important first step in a long path to find consensus and

general guidelines on dealing with the rapid advances in neuroscience. The opportunity to overcome these major new challenges and to make the benefits outweigh the harms for society must begin with a collaborative, interdisciplinary effort with a focus on ethical implications.

It would be optimal to develop ethical frameworks in advance of runaway applications of technology. Rather than wait for the problems and complex ethical dilemmas to materialize, it would be prudent to discuss future scenarios with all stakeholders in order to mitigate potential harms. This should ideally begin at the research phase as these scientific advances are designed and tested.

Science is usually self-driven, but no one person is in the driver seat. Setting social norms based on respect for the differences among humans will set some limits and provide a regulated path for the rapidly advancing field of neuroscience and related technologies such as neuroimaging. As one of the major religions, and second largest globally, Islam offers some solutions and challenges to the application of advanced neuroimaging and of neuroscience findings in general. Given the complexity of neuroscience research ethics, which goes well beyond the defined and known medical and research ethics of other medical sciences, the discipline of neuroethics ideally needs to recognize and address the ethical principles of major religions. At the very least, special considerations should be undertaken in therapeutic or research settings when involving individuals from the Islamic faith, or from other faiths, in order to accommodate their moral codes and ethical restrictions.

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