Neuroethics: a discipline under construction

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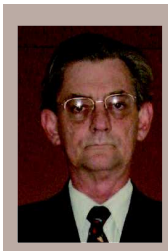
Abstract

We are living a moment of great hope stemming from technological (technological) innovations in neuroscience. These advances have led to an explosion of studies in cognitive, affective and social neuroscience. The goal of diagnosing, treating and preventing diseases that originate in the brain is laudable and relatively protected by the ethical guidelines established over time. But this remarkable progress has brought with it enormous ethical, legal and social challenges, especially because of the possibilities, not desired, of the application of these Technologies. Some are of practical nature, related to neuroscience applications and their implications for individuals and the society. Others more philosophical, concerning the way we think of ourselves as persons, moral agents and spiritual beings. It is some of this challenges that will occupy us in this article, bringing a number of recommendations, care and ethical questions unique to neuroscience continuing work published.

Key words: Neuroscience. Neuroethics. Challenges. Recommendations.



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But in fact morals is the most humane of all subjects. It is that which is closest to human nature; it is ineradicably empirical, not theological nor metaphysical nor mathematical. Since it directly concerns human nature, everything that can be know of the human mind and body in physiology, medicine, anthropology, and psychology is pertinent to moral inquiry (...). Moral science is not something with a separate province. It is physical, biological and historic knowlege placed in a human context where it will illuminate and guide the activities of men.

Dewey, 1922

Recent studies began to clarify neuroscience from human complex social behavior, such as love, trust, extroversion, neurosis, empathy, lie, consumption preferences, and even brain mechanisms used in moral decision making, denominated by many as neuroscience of ethics. Other

Studies have dedicated to research about what is conscience and what is to be conscious. The majority of these positions is not speculative. Much of this knowledge is coming out from laboratories to society. Based on this knowledge, one works in neuromarketing, in courts, in drug addiction, in neuroeconomics, in neuro-cosmetics, in detection of lies, in autonomy for decision making, and in national security, just to mention a few. À New ethical, legal, and social challenges arise as generated knowledge is used.

Body and soul

Many people believe that mind and body are different beings. As neuroscience evolves, more and more of human thought, feeling, and action are explained in terms of brain work, a physical organ of the human body. Even the relationship between religious experiences and the brain was perceived in patients with epilepsy of the temporal lobe, whose convulsions are followed by strong spiritual feelings. Recent research showed characteristic images of brain activation associated to spiritual transcendence states, common in Buddhist meditation and in Christian prayers [1].

Conscience

Conscience is perhaps one of the biggest mysteries of science. How can a entangled mass of tissue give origin to emergence of conscience, of perception, or of the subjective experience? How a relatively simple collection of tissues, although very organized of physical components, enables the experience of pain, of a special hue of red or the perfume of a flower? Our inability in answering these questions from brain activity is for some na argument against materialism; for others, it suggests that it is due to our lack of knowledge. Both science and philosophy were challenged by these questions, and Roskies [2] suggests that neuroscience is in the way to answer them.

The issue of conscience was and still is primarily a philosophical issue, but today it is a scientific issue as well. For Roskies [2], if there is a science capable to answer the question about *what is conscience and how conscience is possible*, this is the neuroscience A large number of ethical questions goes with scientific questions because demystification of conscience, if it happens, will affect certainly how we think, it may have impact in religious convictions and, probably, will have ramifications on how we understand our place in the natural world, as well as that of other organisms.

Although the possibility of determining what is conscience and of what is to be conscious still is far way (if one day it will be possible to reach it), this does not mean that we should not worry, in as much as the arising of ethical questions related to it [2].

States of conscience

When a patient suffers a serious brain lesion by trauma or by cerebrovascular accident,

he may lose conscience completely and enter in coma, a state of total irresponsiveness, with closed. This state is normally self-limited, evolving during a variable period of around two weeks. The patient, after this period, may recover conscience, and entering in the denominated *vegetative* state or having his clinical evaluation and complementary exams characterizing encephalic death [3].

Jennet and Plum [4] identified, in 1972, the vegetative state (VS), and they described as a syndrome. Basically, it is a brain state in which patient is not conscious, but his brain continues exercising the automatic functions of the body, carried out by the intact brain trunk, which controlled breathing, cardiac frequency, the waking up and sleeping cycles, and the reflexes. Researchers characterize such state as *irresponsive* woken up, that is, the eyes could be opened, but as if they were not aware of the self, of others, of the environment. This brain state reflects in a simple way the recovery of the brain trunk, responsible by the autonomic activity in the absence of the cortical function.

Two consensuses about the vegetative state were clear [5]: of VS, patients could evolve to encephalic death, which by definition is the death of the entire brain, including the cerebral trunk (criterion for donation of organs and synonym of the individual's death); they could recover consciousness or maintain themselves in VS. If the VS lasted for a month, it was denominated as persistent, and if it remained for three months in cerebrovascular accidents and for twelve months in traumas, it was denominated as permanent VS, indicating that patient did not have any chance of recovery. This temporal distinction was based in the difference of causal mechanisms of neuronal death by anoxia or trauma.

A special concerning issue regarding characterization of conscious states is the recently discovery of a compromising state of consciousness denominated as *minimally conscious state* (MCS) [3]. In this clinical condition, the patient is in vegetative state, independently of time (over 3 or 12 months), but the neuro images are able to show cerebral islands in activity. This condition may evolve toward an emergence of the minimally conscious state and, finally, recovery of consciousness. The Discovery of the MCS was due to technology development for brain mapping, since images opened a window to establish patient's state of consciousness, which otherwise would not be able to manifest.

The expressions *persistent vegetative* state, *permanent vegetative* state (PVS), and the *minimally conscious* state have been ill-interpreted even by some physicians, and they have generated and still generate much confusion, as occurred with the patient Terry Schiavo, who fulfilled the permanent vegetative state criteria (therefore, irreversible, without recovery or clinical evolution), but who eventually opened the eyes – that for many are "the windows for the soul". Fins wrote that in that time he *imagined the superior part of the brain as a gelatinous mass floating above the brain trunk*

and that *with a so important lesion, leading to PVS, this would be possible only a state of loss of permanent consciousness, instable forever* [3]. The Schiavo's case should be taken into consideration and set in contrast with that of other patients who are in MCS, with the possibility *of achieving a minimally conscious state to recover cognition*.

Before the description of this MCS and the possibility of exams by the Functional Magnetic Resonance Imaging (fMRI), which can show brain islands in activity, many thought [6] as Fins, and this was a simple and convenient axiom. Convenient because, thanks to the progress of medicine, many patients in the last three decades of past century, who before would die, now were kept alive for more time (although not always in better conditions). The case of Karen Ann Quinlan was paradigmatic for indicating the direction for the path of a worthy death. The episode, involving many scientists and bioethicists, generated intense discussions, and apologies in favor of limiting futile treatment due to pious orders of non-reanimation throughout the world, inclusively in Brazil, emerged.

By a laudable process, targeted to assure dignity of patient in terminal status, many of them had a more comfortable and humane death, sometimes out of the intensive therapy units (ITU), at home or in hospices, helped by non-reanimation orders (NRO), vital testaments, and other innovations. Patients or family members' appeals were met often, removing the hindrances to the inevitable process of dying. But sometimes facts were bothering: reports of patient that, after long time in vegetative state, suddenly presented some sign of consciousness, either by means of a Word or apparently voluntary movement – were in MCS, as we know now.

The MCS is a consciousness disorder that got into medical lexical from the formulation in the Apsen Criteria in 2002 [6]. Patients in MCS presented evidence of consciousness showing intention, attention, memory, perception of themselves, of others, and of the environment. The challenge is that these behaviors are episodic, intermittent, non-reproducible, which often turns these patients' conditions undistinguishable from that of those who remain in vegetative state, particularly for untrained eyes or in isolated exams.

MCS is a crucial diagnosis, as it configures a condition possible to evolve to recovery, to the emergence state of the MCS and, finally, to full recovery. However, it is difficult to foretell the possibility of arising the MCS, to forecast *when* and *if it will occur*, since time that a patient may remain in this condition usually is measured in months, years and, sometimes, decades. In Terry Wallis' case, it occurred 19 years after the cerebral trauma [7].

This variation in time and amount of recovery is due to heterogeneity of these brain states, and the difficulty to make prognosis.

It is toward these issues that several articles dedicated to the topic arise. Reality, today, is that with advanced technology of neuroimaging it is possible to identify patients in MCS, although this does not provide assurance regarding evolution of the condition. Fins adopts Richard Rorty's words, pronounced in a dispute with French philosophers Pascal Engel about truth: *our responsibilities are exclusively toward other human beings, not toward reality* [8]. MCS diagnosis is not a practical reality yet. But we must have met some patients in MCS family members' appeal for the non supply of measures considered as futile in the past.

Perhaps, in future, patient will be able to provide us a response of yes or no type on the NRO, about pain or discomfort that he feels, once the works of Monti, Vanhaudenhuyse, Coleman, and collaborators [9] showed that even patients incapable to physically respond are capable to understand verbal instructions and to replicate in a differentiated way. These studies suggest that some patients were conscious and they retained the power to respond with volition or intention – which may increase their autonomy, allowing them to make choices.

Privacy

What is especially challenging in the new technologies of brain study is the foreseeable and without precedence access to human thought, as well as the need to keep the paradigmatic respect to privacy and confidentiality.

The assumption regarding privacy, in relation to what exists currently, is that others cannot and should not collect or have Access to our information without our effective knowledge and free and clarified consent.

The assumption, regarding thoughts, is that, independently of intentions, others should not read our thoughts and, thus, invading our privacy [10]. It is not uncommon in debates on privacy that we refer to privacy of thoughts as a basic paradigm: *the only thing that no one can control is my thoughts*. The core of the issue is that our thoughts that is, arguments, motivations, attitudes, wishes, and values – are ours, integrating the notion of the self, which constitutes our personal identity. Our brains are us, which our genes were never able to be.

There is significant difference between genetic data (in whose research area these challenges were placed) and the thinking processes, both important for establishing our identity. Certainly, genes have influence over who we are, but our thoughts are significantly more central to awareness of the *self*. Our genes, inherited from biological parents, are significantly not ours: a mixture of genetic inheritance of our antecessors; thus, they are a little o four relatives (parents, grandparents, brothers, descendants), as well as they are us. Such fact happens because our genome is not an exclusive personal information. Our genome and genetic information constitute a family identity that, inclusively,

can be the cause of specific diseases.

Our thoughts result, in strong contrast to the consanguineous transmission of genes, even if subjected to family influences, from the influence of many other sources, including (centrally) ourselves. Our thoughts are the basis of our all acquired, refined, reviewed, and forgotten, histories or retold by introspection derived from time and continuous experience of life.

Our histories (produce of our thoughts and existences) are built and kept in intimate personal relationships, as well as from social relationships that are more distant from mutual acknowledgement. Expressed in crucial way in our thoughts, they tell us who we are, from where we came and to where we are going in a more distinctive way than what our genes could tell.

Thoughts are the material of our lives and language with which we constitute and tell to ourselves our histories, and also the way as we prepare them to tell others. We build our identity, the narration of our personal life by arranging and ordaining experience and Idea, giving greater weight to some thoughts and discharging others. The narration of the life of each of us may go in many directions, partly subjected to our choices, partly subjected to circumstances, partly subjected to our wishes or needs and, in major part, subjected to replies of others.

A crucial feature in the development of these personal narratiions is its role in communication: this process involves thoughts, more or less worked out internally and tested against the replies from others, which may accept, reject, or confirm them, or still be kept neutral to our histories. We Record these responses and we reply to them. The private phase of this process is, without any doubt, basic to forming our identity, as argues Sissela Bok, quoted by Reid and Baylis [10]. A The possibility that one or more neurotechnologies would surpass this communication and, one Day, expose these private instances in the personality formation process is what may be characterized as crucial invasion into our identity, which may reset its construction process [10].

Moral decision making

Decision based in values is disseminated in nature. It may occur when an animal chooses between several options, basing itself in a subjective value that it attributes to each possibility. Several researches study the processes that the brain carries out aiming at decision making, mainly based in values, seeking to build a theory, biologically acceptable, about how humans make decisions, which may be applied in natural and social sciences. Several areas of knowledge contribute with these studies, such as psychology, neuroscience, and computers science, among others.

The only way to study moral cognition, until recently, was deducing it from behavior, observing people's actions or checking their responses to situations that require a moral opinion. However, neuroscience evolution and its application in realms, increasingly more abstract of cognition, outlined new methodology to investigate moral reasoning.

Everything indicates that in human species evolution, some of our moral values came from emotions and not from reasoning, and they constitute the force that guided moral action. The success of these primitive hominids was based in reciprocal altruism in social sharing of resources. In parallel, during evolution there must have been a trend toward selfishness (to take resources and not sharing them) as survival strategy of the species. Morality, at this level of development, is guided strongly by emotions, relatively automatic, and there was not or there was little cognitive control. When societies became more complex, moral reasoning turned to be more important to solve moral dilemmas and to regulate the expression of emotions. In such context, psychopathy has been seen as full expression of the taking advantage strategy [11].

Neuroscience of moral cognition can increase evaluation, forecast, and treatment of behavioral disorders. To understand neurological basis of moral cognition Will help choosing environmental, psychological, and medical interventions needed to promote pro-social and collective wellbeing behaviors[12]. Rangel, Camerer, and Montague [13] under cognitive neuroscience point of view, propose how context-dependent cultural, semantic, and social knowledge, as well as motivational state can be integrated to clarify complex features of human moral cognition. They refer that three models of decision making structures are under analysis and they comprise five phases: 1) scenario representation; 2) valuation of different courses of action under consideration (which is the value of each action?); 3) selection of action; 4) the outcome of selected action (warding or dooming); and 5) learning for future decision making.

A common datum in the antisocial behavior is rules breaking, central to criminal, violent, or psychopath individuals, expressing their incapability to follow moral standards. Raine and Yang [11] summarize the main finding of researches with neuroimaging in antisocial behavior and in moral reasoning. They quote the main brain areas functionally or structurally committed in people with this type of behavior, as well as the most usually activated regions in tests that require moral judgment. Even if this neurobiological predisposition is just one among the several biosocial processes in the antisocial behavior etiology, raises moral questionings that are significant for the legal system and for neuroethics.

Researches undertaken until now suggest that the emotional is more committed than the cognitive in

anti-social individuals. Apparently, psychopathes who acquired this condition in adulthood have excellent reasoning skill when discussing hypothetical moral decisions, but they fail in following up these rules in presented real situations. The studies indicate also that the sooner the antisocial commitment appears in childhood, less competence individuals have for moral reasoning, apparently because there was not this learning. These works show that *sensibility* on what is right or wrong is the predominant deficiency in the antisocial group, more than knowledge of what is wrong or correct.

Despite major difficulties still existing on the understanding of moral decision making, neuroscientists and legislators are alert of implications that it may have for society, Law, and civil society. Psychopaths may not be morally insane, in a strict legal sense, since they are cognitively capable to distinguish right and wrong. But, if they are inapt to feel what is morally correct due to neurobiological incapability behind their control, are they fully responsible for their criminal behaviors? If not, which are the implications for punishment, as well as for our concept of justice? This is the challenge comprised in the interface between neuroscience, law, and neuroethics [11].

The available studies' findings suggest that: 1) ill-behavior caused by prefrontal damages is invariably accompanied by other disorders of emotional behavior, which include diminishing of general emotional reactions and, specifically, compromise social emotions such as compassion and shame; 2) the behavior that can be classified as morally unsuited is accompanied of other losses in decision making, such as scarce planning of several daily activities, and a mediocre management of human relationships; 3) this ill-behavior is not accompanied by deficits in perception, movements, conventional memory, language, and general reasoning skill [14].

The fact that an individual hás a suitable moral behavior and after a lesion in certain area of the brain he changes his behavior shows that some cognitive attributes are related to brain areas. Damasio considers ethics as one of the first and most glorious creations of human mind, which is manifested in simple human behaviors: in social conventions, moral rules, in the sense of justice, and in the basic laws [14]. ParaBehind the Genesis of ethics, for the author, in the history of humanity are the genetically inherited and automated phenomena, which we denominate as emotions and their respective feelings. He believes, therefore, that ethics is a product under construction, motivated by emotions that combine with reasoning to model what we know as good sense, which works from culture.

Several applications of this knowledge are under way. In psychiatry, for example, as psychiatric diseases involve failure in one or

more decision making processes, such as the representation of alternatives, the valuation of each of them, the comparison among actions, and the learning from each choice made. The better understanding of these processes may lead to better diagnosis and treatment.

Thus, the old clinical, ethical and legal issue reappears that refers to responsibilities of individuals with brain diseases. If we accept that schizophrenia is a brain disease, how should we deal with violent or criminal behaviors that individuals with this pathology may present? The same can be said of drug addicts, considering them as brain disease carriers. If they practice crimes taken by compulsion for drugs, how to make them accountable or deal with them? These considerations exemplify the roll of new ethical and legal issues that may show up from studies in neuroethics.

In the legal sector, the core issues in many legal procedures is defining and measuring if the individual was in full command of his decision making faculties. Western courts considered, for over 200 years, the "not guilty due to insanity" appeal from accused carriers of mental problem, which made them incapable to understand how much their acts were wrong. This was a hard task, until recently, for forensic psychologists and psychiatrists. Now, neuroscience new techniques may help them.

The modern advances off RMI technology provides neuroscientists the opportunity to prize more deeply brain contribution in human behavior and in decision making. This new knowledge still are little known by the forensic psychologists community, despite offering better understanding for legal decision from a biological perspective, which may have major impact in intention (of crime) and in culpability, resulting in a more deterministic view of the antisocial behavior [15-21]. For Ahoroni, Funk, Sinnott-Armstrong, and Gazzaniga [17] neuroscience may offer just descriptive models of brain organization and function. In the other hand, attribution of accountability is unmistakably prescriptive. Thus, neuroscience would be much more limited in conclusions that it may support than the public and legal system – been vulnerable to abuse as any other new science.

Still concerning neuroscience controverted use Martell [18] finishes the article with this phrase: *Here is the baby (neuroscience) and here is the bath water. The court may want news from the former, but should not bath too much in the latter* [22]. He states that there are deep differences at a basic philosophical level between views on how law and neuroscience see criminal accountability issues along a continuum, from free will to determinism, and that there are still significant limitations in current state of researches in neuroscience, considering its ability to inform the legal realm on moral decision making of subjects under evaluation.

Buller [23] advocates that there is a basic difference between facts and values, that is, between what things are and what they should be. Based in this distinction, he suggests that we cannot draw normative conclusions of descriptive premises. But he admits that if we consider conscience as necessary condition of personality or, more controvert, that rationality is a necessary condition for accountability – and neuroscience identifies how these capabilities are connected -, it becomes difficult to resist the notion that at brain function level is relevant to determine our moral obligations concerning others or for the accountability mission. However, he does not accept that neuroscience could replace normative issues for scientific issues, warning that one cannot allow it to be done.

It is increasing clearer that moral opinions are not only the outcomes of introspective thoughts, led isolated from emotions. Rather, researches with images have suggested that the affective systems and the cognitive processes behind moral decisions are active when individual weighs his action in a moral context. There is a complex interaction between cognition and emotion during formulation of a moral decision, at least in modern men.

Free and clarified consent

Learning about decision making should be applied also in free and clarified consent (FCC), in as much as progress in neuroscience will allow revealing the neurological correlates of psychological process involved in relevant ethical notions such as the FCC[24]? Neuroscience of decision making may be able to contribute for a FCC ethics, providing empirical criteria and, consequently, descriptive criteria. However, how descriptive criteria should be distinguished from normative criteria, the neuroscience of decision making cannot replace FCC ethics.

The fact that individuals with brain disorders are especially vulnerable sets another particular issue: informed consent, for example, often is complicated by cognitive deficiencies, by susceptibility to coercion or to incentives. Many neurological diseases that lead to emotional and/or cognitive disorders associated to specific changes in brain function may contribute in these patients' inability to provide a valid FCC. A particularly interesting situation and under study deals with advanced consent by people that present the first signs of insanity [24].

FCC neuroethics raises empirical and conceptual issues. The empirical issues relate to psychological and neural processes involved in special type of decision making that characterize FCC. The investigation of this neurological and psychological process may contribute to set empirical criteria for valid FCC. Northoff [25] proposes a FCC that involves complex psychological processes in decision making and normative values, reflecting the respective socio-cultural context.

He advocates the Idea that neuroscience of decision making may contribute to the development of empirical criteria for FCC and he does not that neuroethics of decision making could be replaced by neuroscience of decision making. Neuroscience, for the author, would be as an amalgam of ethics and neuroscience, in which descriptive and normative levels are complementary to each other without any be diminished or eliminated.

Which neurophysiologic functions are needed for decision making in FCC? The cognitive skills such as understanding, enjoying, and expression of choice and rationale advocacy predominate. Emotional skills were much neglected. However, considering recent empirical studies, the inclusion of emotional skills is urgent. Damásio [14] demonstrated that decision making is emotionally guided and modulated. This requires not just cognitive function. Decision making in FCC may, subsequently, be described by the interface between cognitive and emotional functions.

Sex

A particularly challenging topic concerns how one prepares to study brain differences between sexes and genders, without establishing biases for discriminations, such as in Francis Galton and Paul Brocca's works. These authors, 100 years ago, used the size of the brain to measure human intelligence (in average, female brain is smaller than male's), which was used to justify inequalities of that time [26].

Lie detection

Two American companies are Just about to release lie detectors, by means of RMI, based in the fact that particular areas of the prefrontal cortex become more active when a person lies. Some of these areas are involved in the detection of errors and inhibition of responses, suggesting that lying involves greater brain work that speaking the truth.

Lie detectors are ethically bad, not because Technologies may provide wrong or doubtful outcomes, but because they are abusive to individual human rights, violating the privacy, the ownership of own body and mind, as well civil assurance against self-discrimination. fRMI acts without the voluntary participation of the subject and the free will disappear. The individual may want to lie, but the brain flow contradicts it. It is, then, compelled, against his will, to testify against himself, his friends, or family members. This may be worse than torture, situation in which one may remain quiet or invent a false story or even lose consciousness by the intensity of pain – and one will never know precisely what the individual thinks [27].

Justo and Erazun [28] argue that lie detectors may have several consequences, among which two outstand: he first refer to the possibility that mere fantasies, illusions, false intensions or memories (not accompanied by acts) may be taken

as evidences against ethical norms and legal theories secularized in the West, based in notions of actions associated with intentionality. A Palestine, for example, may have the desire that Israel disappears, but this does not mean that he plans an action to carry out his desire. The second relates to loss of individual autonomy, in the sense of having the possibility to elect own norms, which has as corollary the loss of human dignity, and it is directly linked to human rights.

Loss of self-control

The debate continues over if addiction can be better understood as disease or moral condition. This debate, which involves the stigma associated to *drug addiction* and access to treatment debate, is, often, motivated by the following questioning: to what extent we can make individuals accountable for maintaining his drug addiction?

The moral view shows drug use as voluntary behavior that people decide to adopt and vice as excuse for bad behavior, a way for addict not assuming their accountabilities. The medical model, on reverse, recognizes that many people take drugs without becoming addicts and with loss of self-control, while a small minority will lose control on use, needing treatment for abstinence crises.

The medical model, as more current perspective, has many advantages in regard to moral model. Acknowledgment that drug use is not Just a matter of individual choice allows for a change in responses to addiction, focusing more attention in treatment and less in punishment, which may contribute to reducing addicts' stigma as morally degraded. There are, really, substantive evidences for the disease model (inclusively catalogued in the International Classification of Diseases – ICD 10), although this model does not solve the issue of voluntary control.

Recent researches in the intersection of neuroscience with psychology suggest that addicted individuals have significant deficit in the cognitive control of behavior, buth this loss of control is not complete and simple. Possible mechanisms and implications are still been studied [28]. Neuroscience and genetic progresses promise to increase the understanding of the reasons for loss of self-control and to help people with dependences, from bulimic to illicit drug addicts. This perspective, however, raises ethical and social issues, related with research itself and with the potential use of discoveries, as well as related to its impact in society: will addicts be able to understand rationally all involved issues in the research and, therefore, will they be apt to decide on their participation in the study?

One considered, until recently, that addicts were able to decide on their own when not under the effect of drugs or undergoing abstinence. This view, however, is

refuted by some researches, who argue that the impossibility of an untreated addict to refuse participating in a study in which he will get drugs for free, suggesting that the free and clarified consent term should be given only by relative or legal responsible [29]. Studies in neuroethics point to an alternative for such deadlock by considering chemical addicts as brain sick, therefore, without autonomy and loss in capability to consent on own treatment. In face of this perspective, the Idea that they should be mandatorily treated for their own good emerged. In the case of crimes, partly motivated by drugs, the treatment would be a cheaper alternative than prison and, perhaps, more effective. Recent consensus of the World Health Organization (WHO) recommends that treatment should be mandatory only if individual's rights were preserved and if it is effective and humane [30].

Neuromarketing

Neuromarketing intends to measure the response of certain area of the brain (limbic system) to a product, showing consumer's desire in buying it. As neuroimaging can measure the unconscious motivation for buying, such datum may be of great value for the advertising and publicity industry, as well as for producing companies that work in the market. Although issues related to neuromarketing still remain controvert, one speculates that there will be an invasion of unconscious data without control of the future consumer.

Recent studies on decision making may explain how advertising works and how they could be regulated [1].

Cosmetic neuroscience

The progress in neuroscience of cognition and neuropharmacology are providing exciting treatment for neurologic diseases.. Many of these treatments may be used also in people without diseases, improving their body and brain functions, modulating the motor, cognitive, and affective systems. These interventions can increase the *quality of life* and they involve ethical questions related to individuals or society. Despite these questionings, physicians certainly will find easily consumers seeking for happiness.

As the purpose of medicine is to recognize the limits of clinical and pathological ratios, the quality of life evaluation has been one the major parameters to evaluate instituted therapeutics. These evaluations seem reasonable, since what is aimed when treating a disease, particularly if chronic, is to enhance patients' quality of life, as given the characteristics of the disease one cannot aim healing. However, if enhancing the quality of life is not always directly proportional to clinical-pathological ratios, then why not considering biological interventions for the individuals' quality of life, having them a disease or not [31]?

The distinction between treating a disease and increase the quality of life is repeated in the difference between therapy and enhancement. Therapy is to treat diseases while enhancement is to improve normal skills. Certainly many agree that therapy is desirable. Contrasting, others will have doubts about improving the normals. Chattergie quotes Fukuyama [32], who states that *the original purpose of medicine is to heal, not transforming healthy people in God*, and he suggests that public policy should restrict research for the enhancement of quality of life in normal people through interventions in the central nervous system. That is, one verifies that it is difficult to set apart research for healing or for enhancement; they mix in as much as it is also difficult to clearly define the threshold of what is disease.

The possibilities to improve bodies and brains fall into three general categories: improving the motor system; attention, memory and learning; humor and emotions. Some of interventions with some of these objectives are available since long ago, Just as alcohol, tobacco, and caffeine that follow humanity throughout history. There are those known in shorter time, even if extensively used after their discoveries, such as the methylphenidate (ritalin). Many others are in the horizon and they may be relatively effective and safe.

Cosmetics neurology rises questioning in four fields, two focused in people and two in society. Even if in this context they are new, the questionings in others are not new and our responses to these other situations may foresee how we will deal with cosmetics cognitive neurology.

The first of them, related to the individual, refers to s*afety*: virtually, all medications have potential adverse effects, varying from simple inconvenience to severe complications and even death. In diseases, we evaluate always the risks against potential benefits. In health states, the risks are more difficult to accept because the alternative is normal health. In our culture, where information about risks are widely known, people are free to make their own options (tobacco, for example). They seem not to bother much with risks in decision making, and several of them accept even to take the considerable risks to the point of incurring in an *irrational exuberance* in face of the desire to increase the quality of life.

The second questioning relates to the *character* and to *individuality*, referring to two possibilities: character erosion and alteration of the individual. Character erosion regards the fact that *pain builds up character* and, therefore, *relieving pain [may] diminish character*. This process works in the same way as that related to win something without working, which can be considered as cheating, except if it refers to a gift. In case where gain is related to any form undue appropriation, it can be considered as fraud, a behavior that diminishes our character.

The issue related between pain and character formation marks us deeply. However, we live with air-conditioning, we feed ourselves with food prepared by others, we travel by plane, we take paracetamol for headache and acidity blockers for heartburn. Although these conveniences may have ruined our collective character by suppression of pain or increase in comfort, few would let them go. Under such perception, a question imposes: to which extent chemical changes in our brain modify our personality and in which way these changes transform essential characteristics of what we consider *to be human*. For example, the fact that we do not feel pain and do not have memory of it, does it change what we are? If we are, in certain way, the summation of our experiences, will we be other if we stop feeling pain?

The third aspect that one needs to question, in collective terms, regards *distributive justice*: if we can make better bodies and better brains, who will have access to them? The process is expensive and insurance companies certainly will not pay for it. There would be inequality, as it happens regarding food, school, and housing.

The fourth and last issue refers to *coercion*, which may be exerted in two ways: one is related to individual search to be "better", responding to what society requires. As examples, there are students who take methylphenidate in epidemic way to produce more and more professionals, who work 100 hours weekly to get richer. Another, is society and its instituions' explicit demand for higher performance. Can a pilot be forced to take medication to have better performance during emergencies? Can hospital suggest that interns to take modafinil to improve their performance in situation of sleep deprivation? The intensive use of these medications seems inevitable. Although restrictions to research and use of these interventions there may exist, by government regulation, journalistic consternation or religious admonition, it is probable that restrictions do not work due to marketing.

Happiness is an inalienable right [31]. One suggests that discussions about the topic should concentrate in two issues, since cosmetics neurology is inevitable: 1) we need an explicit notion of what human being means. And where can we motivate our choices to improve our movements, our reasoning and humor? 2) we must have a clear notion of physicians' involvement. This meaning will be especially important if we abandon our origin (as physicians) of treating or preventing diseases. Chatterjee [31] sets up a few questions to show that it is not easy to avoid neurocosmetics, challenging the reader:

1. Would you take a medication, with minimal side effect, if it would speed up urgently needed Chinese learning?
2. Would you give a medication to your son, half hour before his piano classes, if this would turn him into an expert?

3. Would pay more to travel with a pilot who took medication to be more skillful in emergencies?
4. Would you like that interns took medications after one on-duty night in order to not make mistakes with patients because of sleep deprivation?
5. Would you take a medication that selectively erased bad memories that disturb you?

In addition to these questionings related to pharmacological use of neurocosmetics, one should consider that non-pharmacological methods to alter brain functions also evolved rapidly during the past decade and, in coming future, may complement the techniques to increase brain functions. Transcranial magnetic stimulation, recently released from laboratories to clinics aiming treating depression, is explored also in healthy patients to alter humor and the cognitive style. More invasive methods such as neurosurgery, vagal and cerebral stimulation, as well as the interfaces between brain and machines, may eventually be used to expand our concept of human brain improvement and, possibly, our conception of human nature [2].

National security

Knowledge is power – *Ipsa scientia potestas est.* Based in this, Canli, Brandon, Casebeer, Crowley, DuRousseau, Greely and collaborators [33] engaged themselves in analyzing the potential uses of neuroscience researches and methods in national security, with involved ethical, legal, and social consequences. According to authors, among available national security technologies are imaging obtaining and cerebral stimulation methods to detect lies and cheat people. Potential subjects would be trusting personnel, enemy soldiers, and suspects of terrorism. It would serve also to increase reasoning capability in key people or to alter social behavior (of friends or foes).

But, according to authors, there are still scientific challenges, due to relevance of its use and applicability, both still non-existing and difficult. Ethical challenges, related to privacy, authenticity, free will, and self-control. Legal challenges because laws and even moral issues related to war would have to be modified. They refer also to public challenges since after the September 11 attacks Americans accept inconveniencies and increase government intromission, although reactions to government initiatives in privacy intromission and in individual choices are seen already.

Finally, they recommend in the study that there should be a partnership between scientists and members of national security for the appropriate application or appropriate resistance to its application, requiring the engagement of an expertise that exists only in the scientific community, and it is very important that these issues are discussed with society [34].

Communication

David Friedman [35] clamours scientists to be *civic scientists* and to leave their laboratories sometimes and keep a dialogue with citizens. He concludes that engagement with the public is responsibility to be accepted by everyone. He argues that it is a moral imperative. Scientists need to go out to streets, show who they are and what they do. Such vituperation leads to consider that as neuroethics field emerges, it is crucial to involve society in discussion as soon as possible in order for future researches be sensible to public desires and positioning.

Now that the brain is accepted as reservoir of the mind, it acquires additional quality as the place of the self, where individual personality dwells. To examine and monitor the brain in action equals, for many, to open a window toward inside the mind, revealing private thoughts. To modify the brain in any aspect has the potential to modify the essence of being. It is not a surprise the interest in researches in this area. But the public is not comfortable always with what studies are showing. Some would not like to know the responses. Others think that knowledge is power. This discomfort is one more reason to include society in the discussion: to prepare the world for what we could learn, and to make common people capable to help discerning how this knowledge may be used. It is not enough to inform the public, it is necessary a genuine dialogue in which all may expose their anguish, desires, and values – which will not delay science but, rather, may legitimate it as instrument at the service of human beings. By not making it, it may be placed under suspicion.

Fins also made observations about journalists, referring to the article in The Economist disseminated in May 2002, where one reads that the new neurotechnologies hit more human dignity and its autonomy than cloning [36]. The author states that society's response to neuroscience development has been fascination coupled with aversion. According to him, in 1939, in the dawn of somatic therapies in psychiatry, the psychiatrist Oskar Diethem warned about popular beliefs and on patients' vulnerability to new therapies: *it is important in medicine to acknowledge in regard to new therapies the responsibilities of those that follows them voluntarily, that is, physicians; those who follow them blindly, that is, the layman public, and those who are force to follow them, that is, the patients* [36].

The editors of the The Economist, who stimulate the debate on the ethical limits of neuroscience, should evaluate the power of their means of communication. With authority comes also the journalists' responsibility. Public opinion on science, for better or worse, may be informed by media reports. The author still reminds, in mentioned article, that layman publications, suggesting empirical bases favorable to the first interventions with lobotomy, between 1935 and 1960, had major role in the regrettable dissemination of

this procedure. He concludes by stating that the hyperbolic view of journalist may be positive or negative, with calamitous consequences, and that The Economist gives false impression that neuroscientist and ethicists have been blind to the moral significance of its work.

Recommendations and synthesis

Researchers should have the following concerns regarding their work when proposing research with human:

- That they have value, that is, research may lead to the improvement of health and wellbeing, or increase in knowledge;
- That they have scientific validity, that is, be conducted in methodologically rigorous manner in order to be trusting or valid;
- That there is fair selection of participants;
- That there is rigorous analysis of risks /benefits;
- That free and clarified consent be obtained;
- That they should be submitted to approval by ethics committee in independent research;
- That there is respect for participants' dignity

Researchers need, given the fast development, to be in close contact with other researchers in many instances of immediate importance in order to maintain transparency of technology, worrying with people's yearns for new technologies and the trend of academia to transfer them; to be sensitized and to suggest guidelines to handle abnormalities, accidentally identified and not object of researches, but that have clinical significance, to make critical evaluation of promises, risks, and implications of molecular medicine and of functional imaging for regenerative medicine; to be aware that appropriate care should be taken with predictions.

More case studies are necessary for comparison and researches need to exchange information, particularly on the exceptional cases. It is absolutely necessary to follow up patients longitudinally, as well as to praise natural history of brain states and to provide prognostic evaluations. Investigators need to establish standards that may be part of meta-analysis. There should be investigators educators to establish guidelines for investigation, education, and evaluation of professionals. Neurosciences students need to get formal education in applied neuroethics.

Neuroscientists need also to worry with new Technologies whose effectiveness has not been evidenced yet, and to explore the social consequences of the effective new technologies. Many investigators are intoxicated by progress, but they must remember how primitive actually is our knowledge and understanding.

As neuroscience is in a phase of pre-discovery of infectious agents – since

we only know that the patient has fever – they should remember also that confusion is the price of progress and that each solved enigma is the prelude of new mystery. Thus, they should never bring in more confusion in the media and less still self-promoting with fanciful news, but rather to adopt a prudent ethical conduct and not use new technologies in the clinical practice before knowing well the operational features, that is, its sensibility and specificity in the clinical practice.

Additionally, it is indispensible not to mix up behavioral indicators with those derived from images until we know more on how they could be used jointly, and to resist the tremendous stimuli for their clinical use while they still are investigative tools. They should recognize, regarding new therapies, the responsibility of those that indicate them voluntarily, that is, physicians, those that follow them blindly, that is, the layman public, and those who are forced to follow them: the patients. Physicians, when pragmatic, should avoid monolithic ideas, recognize pluralism, and to valuate other health areas, as well as the multidisciplinary approach.

Neuroscience can offer only descriptive models of cerebral organization and function. The attribution of responsibility, in parallel, is unequivocally prescriptive. For now, neuroscience is more limited in conclusions that it can sustain that the public and legal systems, and as any new science is vulnerable to abuse. Courts need to be absolutely secured about validity and reliability of brain evaluation technologies, either to access activity/function or brain intervention before allowing that they are freely used in legal or judicial issues. Evaluations of the conscious state through images still are in the descriptive stage and not in that of diagnosis.

There must be a multidisciplinary approach to evaluate exaggerated use of psychotropic, anxiolytics, and cosmetics pharmacotherapy. Frequent request of these medications causes discomfort to physicians. The use of medications and other techniques to increase performance still are of high clinical risk, among other considerations.

Media must evaluate its power. With authority also comes responsibility. News based in just abstracts do not reflect the entire truth, and they do not allow a critical analysis.

We should use always the principle of doubt: when receiving a proposal for exams, medication, participation in research, we should reflect, valuating option, deciding for the highest value choice. We should learn with the outcome of the choice and use it in a coming decision. We should not forget emotions and circumstances, which always take part in decision making.

Care

It is necessary to take care with the risk of exaggeration that scientists may suggest to us

about what they seek, find, and do. What happened with genetics is a good example of this, which can affect scientists, media, bioethicists, and society. As brain structures interconnect and are able to exert several tasks at the same time, no single intervention will have unique consequence. Any intervention will have great risks/benefits interrogations.

Be careful with advertising. They may have been prepared so you do not resist buying. Use the principle of doubt. Concerning communication, scientists and all those opinion makers need to have clearly the importance of the genuine dialogue with society about what they do and think, knowing that such attitude is categorically critical to promote a fair and participatory society in which historical tragedies are not repeated, Be careful with the impact of magnetic resonance colored images in emotions and judgment at courts. Neurosciences promises to inform psychology and law are promising, but they are not ready yet.

On the transparency of technology there should be a balance between risks/benefits, worrying with the anxiety of the public for new technologies and the academia trend to transfer technology. And finally, be careful with fads. Health is susceptible to fads as well. How many times did the ideal diet change already? How many people currently are bipolar? How many children have attention deficit disorder and hyperactivity? One recommends that all stakeholders, professionals and user to analyze the trustworthiness of information sources.

Ethical challenges

Next, it is listed a series of ethical challenges deriving from application of neurosciences discoveries that are the core of the new neuroethics discussions. Such challenges, synthesized in direct formulations, remit to classic ethical issue, now considered under new drapery, which derives from the biotechnoscientific perspective, mixing, however, to original considerations arriving from the improvements gotten in the area:

- Which is the limit of invasion to our privacy?
- What could justify lie detection?
- How do you obtain free and clarified consent from people with neurological deficits (newly discovered)?
- How to avoid getting surreptitious information?
- Can people with insanity prodrome do an advance consent?
- How does one respect the research subjects autonomy when they need to be cheated?
- How does one handle the findings of abnormalities with clinical significance that are detected and are not object of researches?
- Will it be acceptable to be induced into buying by marketing against our will?
- Will it be necessary a criminal mind beyond a criminal act (children, mentally sick, drug addicts)?

- UÊ Will it be better to correct the brain instead of arresting (or kill)?
- How does one neutralize the impact of fRMI colored images in members of the jury and judges during trials?
- How does one solve the difficult issue of conceptualizing and identifying what is normal or pathological? And the variants of normality?
- With which guidelines could we accept researches on higher brain functions that can carried out only in human beings?
- Should diseases without available treatment be sought for?
- How does one handle social and cultural consequences derived from progress?
- Who will have access to the benefits of the technological progress (due to cost and availability?)
- How does one regulate cosmetic neuroscience?
- Could the discoveries from research done withhuman beings be hidden for national security reason?
- Which will be the status of human being in current post human world?

Philosophical challenges: mind/brain, awareness concept, decision making control and free will, understanding of moral reasoning emotions of decision making, reference to immaterial minds.

Final considerations

Obviously, society is anxious for researches that could help attenuating suffering from degenerative diseases, changes in humor, schizophrenia, and better solutions for drug addiction and violence, among other widely disseminated social problems, related with improvement of quality of life and security. Thus, it is the civic duty of researchers in health and correlated areas to develop generalizable knowledge that leads to human biology understanding, having as purpose the understanding of etiology and pathogenesis of diseases, and the perfecting of prophylactic, diagnostic, and therapeutic procedures.

We cannot forget that when scientists think on ethical values, they usually assume that they are obvious and implicit in what they do, but it was not always like this, and probably it is not or will not always be. There is the need of an open dialogue with society, in which they can say who they are, what they think, do, and how they do it. It is not enough for scientists to be ethical. It is necessary that they seem to be.

Resumo

Neuroética: uma disciplina em construção

Estamos vivendo um momento de grandes esperanças advindas das inovações tecnológicas na neurociência, que levaram a uma profusão de estudos na neurociência cognitiva, afetiva e social. A meta de diagnosticar, tratar e prevenir doenças com origem no cérebro é louvável e relativamente protegida pelas normas éticas estabelecidas ao longo do tempo. Mas este notável progresso trouxe em seu bojo enormes desafios éticos, legais e sociais, principalmente pelas possibilidades, não almejadas, da aplicação dessas tecnologias. Algumas, de natureza prática, referentes às aplicações das neurociências e suas implicações para os indivíduos e a sociedade. Outras, mais filosóficas, relativas à maneira como nos pensamos como pessoas, agentes morais e seres espirituais. É de alguns desses desafios que nos ocuparemos neste artigo, trazendo algumas recomendações, cuidados e questionamentos éticos peculiares à neurociência, dando continuidade a trabalho anterior.

Palavras-chave: Neurociências. Neuroética. Desafios. Recomendações.

Resumen

Neuroética: una disciplina en construcción

Estamos viviendo un momento de grandes esperanzas derivadas de las innovaciones tecnológicas en neurociencia. Estos avances han conducido a una explosión de estudios en neurociencia cognitiva, afectiva y social. El objetivo de diagnosticar, tratar y prevenir enfermedades que se originan en el cerebro es loable y está relativamente protegido por las normas éticas establecidas a lo largo del tiempo. Pero este notable progreso ha traído consigo enormes desafíos éticos, legales y sociales, principalmente por las posibilidades, no deseadas, de la aplicación de estas tecnologías. Algunas de naturaleza práctica, en relación con las aplicaciones de la neurociencia y sus implicaciones para los individuos y para la sociedad. Otras más filosóficas, sobre la manera en que pensamos de nosotros mismos como personas, como agentes morales y seres espirituales. Es de algunos de estos desafíos de los cuales nos ocuparemos en este artículo, trayendo algunas recomendaciones, cuidados y cuestionamientos éticos relacionados con la neurociencia, a continuación de trabajo publicado.

Palabras-clave: Neurociências. Neuroetica. Desafios. Recomendaciones.

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