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Anthropological and Ethical Dilemmas in the recent Development of Neuroscience

Anthropologische und ethische Dilemmata in der neuesten Entwicklung der Neurowissenschaften

Zusammenfassung

Einleitend wird aufgezeigt, wie es zu der bedeutenden Entwicklung der Neurowissenschaft kommen konnte. Grundsätzlich kommen zwei Faktoren zum Tragen: einerseits die interdisziplinäre Zusammenarbeit, andrerseits die innovativen Techniken zur Erfassung neuer Informationen über das Gehirn. Die Entwicklung hat uns zu einem besseren Verständnis des menschlichen Gehirns geführt, aber auch zu Fragen, die über die Neurowissenschaften selbst hinausgehen. Diese Fragen sind aus folgenden Gründen von Bedeutung: 1. experimentelle und therapeutische Verfahren der neurowissenschaftlichen Ergebnisse können auf den Menschen angewandt werden wie nie zuvor. 2. Notwendigerweise produziert die Neurowissenschaft Fragen ethischer, anthropologischer und philosophischer Natur, im weitesten Sinne die Identität menschlicher Wesen betreffend. 3. Die Neurowissenschaften geben Anlass, ihre eigene Formulierung und ihre Paradigmen zu hinterfragen. Daher müssen wir selbst den medizinischen Grundlagen und insbesondere der Bedeutung experimenteller Ergebnisse kritisch gegenübertreten.

Schlüsselwörter: Neurowissenschaft, Neurophilosophie, bildgebende Verfahren

Abstract

This article begins showing the factors of the powerful development of neuroscience, which are basically two-fold: first, the interdisciplinary collaboration and, second, the new techniques used to obtaining new data about the brain. This development has allowed us to knowing better the human brain, but it has also raised questions that go beyond the neuroscience itself. These questions are very important for three reasons: First, because the experimental and therapeutical applications of the neuroscientific results could be now applied on humans as never before; second, because neuroscience necessarily raises questions —ethical, anthropological and philosophical— concerning the identity of human being in a broader way; third, because neuroscience raises questions that exceed its formulation and its paradigm. Therefore, we should ask ourselves about the methodological questions, to question the meaning of the experimental scientific activity in itself.

Keywords: Neuroscience, Neurophilosophy, Neuroimaging

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1. The Recent Development of Neuroscience

The spectacular development of neuroscience in recent decades is due fundamentally to two factors: its capacity to integrate or to collaborate in an interdisciplinary fashion with other sciences; and, the powerful progress of techniques for obtaining data unthinkable up to now. These two factors have helped one another over time which has demonstrated that both need each other.

In regards to the first factor, it is important to highlight that this dialogue and interdisciplinary collaboration does not refer only to experimental disciplines (medical and biological), but also to humanistic disciplines. To the surprise of many scientists, the facts have demonstrated the development of neuroscience that have also recently been made possible thanks to the vision offered by the human sciences. These sciences have collaborated with experimental science in offering a vision of the whole, and of the meaning of the experimental data; although they have also caused the emergence of very fundamental problems and questions for experimental science.

In respect to collaboration with the diverse experimental disciplines, neuroscience is certainly a discipline characterized by a synthetic approach which is integrative of all those sciences dedicated to the study of the normal and pathological nervous system. This fact made itself especially manifest during the decade of the 1960's and the early 1970's. In these years there arose initiatives such as: the founding of the International Brain Research Organization (IBRO); the start-up of the Neuroscience Research Program at the Massachusetts Institute of Technology in Cambridge (Massachusetts, United States); and, the creation of the Society for Neuroscience, which is also in the United States.[1]

With respect to the collaboration of the human sciences, the best example is perhaps the figure and work of Eric Kandel. This professor performed his undergraduate studies in History at Harvard; upon graduation, he began studying Medicine at the School of Medicine of New York University, being awarded the Nobel Prize in Physiology or Medicine in the year 2000. Leading the Department of Psychiatry of Columbia University (New York), Kandel initiated interdisciplinary instruction, culminating in the publication of a series of important textbooks concerning the study of neuroscience; and, based on an integrative perspective on the teaching of neurobiology.[2]

As a second factor in the development of neuroscience, we indicate the progress of certain techniques; among which the techniques of neuroimaging must be emphasized. There certainly already existed precedents to neuroimaging in the cerebral angiograph (developed in the 1930's by the Portuguese Nobel Prize winner in Physiology or Medicine António Egas Moniz), in cerebral ventriculography; and, in the technique of electroencephalography, although these techniques were indirect and too imprecise. The key developments in this direction were without doubt: computerized axial tomography, developed by Allan Cormack and Godfrey Hounsfield (Nobel Prize in Physiology or Medicine in 1979); and, functional Magnetic Resonance Imaging (fMRI), developed by Paul Lauterbur and Peter Mansfield (Nobel Prize in Physiology or Medicine in 2003). fMRI permits detecting the changes in the distribution of blood flow when the individual undertakes determined sensorial or motor tasks; and, according to distinct cognitive, emotional or motivational paradigms. This technique, together with Positron Emission Tomography (PET) and magnetoencephalography has come to be the most important tool for the development of a neuroscientific subdiscipline with a great experimental repercussion and media recognition known as: cognitive neuroscience.[3]

In addition, however, neuroscience has also been strengthened by its collaboration with psychiatry. This discipline possesses the peculiarity of being a hybrid between the experimental and the human sciences, above all because it deals with human problems as grave as illnesses that affect the person globally, and at times in a dramatic manner.

It is sufficient to think about the fact that: according to the data of the National Institutes of Health of the government of the United States, there are currently 20 million Americans with depressive disorders, and two million that suffer from schizophrenia. It is logical therefore that neuroscience is occupied more and more with the study of these diseases. In the most recent congresses of the American Society for Neuroscience, the articles related to psychiatric disorders have been multiplying exponentially; this has also been very actively influenced by a profound transformation of psychiatry in recent years. This medical discipline has refocused its efforts on the analysis of specific illnesses with an application of neurobiology which is constantly more profound and operative. Psychopharmacology and the development of a psychotherapy are much more linked to cerebral neurobiology and to neuroimaging and have resulted in a vision of psychiatry as a crucial discipline in the study of the human brain: what it is like, how it functions, how it falls ill, and how to cure it.

Finally, another aspect that strengthened the development of neuroscience was the declaration of the so-called: "Decade of the Brain" (from 1990 to 2000), on the part of the then-President of the United States; of course, an immediate effect consisted in economic investments which provided for carrying out very expensive neuroscientific research; the declaration itself also strengthened and broadened the framework of neuroscience. In addition to emphasizing the importance of the study of the brain in the fight against nervous system disorders, this declaration highlighted the crucial role of this research in order to better understand the human being and improve his or her living conditions. Another not insignificant effect of this declaration was the enormous prestige and recognition on the part of the media that neuroscience received. On the other hand, the fact that neuroscientific research could be performed in a non-invasive fashion on healthy or sick human beings contributed to an even greater prestige for this discipline, due to growing ecological worries and to protests against animal experimentation.

With regard to our topic, we must add two clarifications: First, that during the so-called Decade of the Brain there was an explicit recognition of the importance of developing research on the nervous system in a context of dialogue with ethics and other disciplines with social involvement; it was demonstrated thereby that the interdisciplinary vocation of neuroscience was not abandoned in these moments of great success in the experimental, political, media and social realms. The second clarification refers to the fact that already at the beginning of the 90's we were discovering that, in reality; neuroscience as such was definitively perplexed when it attempted to explain the deepest foundations of the falling ill of the nervous system, of complex alterations such as neurodegenerative diseases; or, of the mental illnesses that we have noted above. In addition, little by little there was an abandonment of a more systematic vision of the nervous system (the so-called neurobiology of systems), which to a large degree had helped to view the functioning of the nervous system with a certain holism; with a certain general vision of the whole.

In this way: We found ourselves, on the one hand, with a greater knowledge of the genetic, molecular, sub-cellular and cellular mechanisms which govern the cells of the nervous system; impelled by the powerful development of genetics and of molecular and cellular biology which was also observed in other biomedical fields (as, for instance, in oncology, cardiology and others); on the other hand, the development of brain neuroimaging demonstrated cerebral activations and deactivations that were not easy to situate in a general context of the functioning of the brain as a whole. It was strange, and even paradoxical to observe that in response to questions such as: "how does the brain function?" the response was one of near perplexity; the striking thing is that this was occurring at a moment in which neural science was at the

peak of its experimental development.

The knowledge of nervous connections (technically termed "hodological" studies, from the Greek "*hodos*", road or way); that is to say, those studies that analyze how the distinct parts of the nervous system were connected, had been of great importance in order to complete a neuroanatomy that we only viewed statically. Neural connectivity helped powerfully to give meaning to the distinct subsystems that govern the morphofunctionality of the nervous system, but these studies gave rise to at least three serious problems: First, they had to be performed on experimental animals, and the results later had to be extrapolated to human beings; Second, the studies of connectivity demonstrated that the connections were much more complex than that which could be inferred in a first approximation; Third, they were important studies from the morphological point of view, but did not directly provide any functional discovery. This latter would have to later be inferred *a posteriori* by studying the connections already made manifest. As a consequence, these projects have been gradually abandoned, to the point that now only a few laboratories worldwide deal with them with sufficient seriousness and depth; but the corollary is also clear: Today we know more details concerning neural tissue, but at the same time we are losing a more systematic vision of how the brain functions as a whole.

The interesting aspect of this whole process is that neuroscientists are now being asked to respond to questions about the functioning and the falling ill of the nervous system which require a profound knowledge of the neurobiology of systems, which —as we have stated above— has been lost in recent years. It goes without saying: questions requiring a neurobiological explanation concerning topics as vital as self-consciousness, freedom or convictions about values and ethics run aground on a perplexity which is difficult to sustain, in a society which expects science to provide clear answers about everything.[4] This perplexity is added to an uncertainty which becomes even greater when, unfortunately, declarations are made or postulates are formulated which affirm, for example, that "everything is in the brain". Affirmations of such generality and rotundity lack a deep neuroscientific foundation, and end up generating more confusion than clarity.[5]

2. The Arising of Dilemmas

The development of neuroscience, thanks especially to its mutual cooperation with other sciences, has strengthened it in an unsuspecting manner; but it has also confronted it, as we have seen, with grave questions and dilemmas. These dilemmas may be divided into three classes: ethical dilemmas of application, foundational ethico-anthropological dilemmas, and methodological dilemmas of scientific activity.

2.1. Ethical Dilemmas of Application

The ethical dilemmas resulting from the application of the techniques of neuroscience, both in the study of the brain as well as in the application of its results, fall into the general framework of bioethics. Indeed, in this climate of collaboration between sciences: in order to resolve common problems, it was logical that with time a concern would appear concerning ethical problems.[6]

We are very accustomed to speaking about bioethics, but we should not forget that we are dealing with a relatively recent ethical discipline. It began in the early 70's with the work of an American oncologist, Van Rensselaer Potter, and his book *Bioethics: Bridge to the Future*.[7] Bioethics is configured as the field of ethics which seeks to provide a basis for principles of human moral action in relation with biomedicine; but due to the contemporary context, bioethics is focused on the field of human life — both its beginning and, now to a greater degree, its end—. In addition, there are two other fields that bioethics treats of: the growing medicalization of society together with physician-patient relations, and animal experimentation.

The most modern and interdisciplinary neu-

roscience has a history which parallels that of bioethics. The fields of bioethics can be related with neuroscience in a very simple manner: on the one hand, the morphofunctional configuration of the nervous system and its falling ill —as well as neurodegenerative diseases and the loss of consciousness on the part of terminally ill patients— are at the base of the problems of the beginning, and end of human life. On the other hand, in recent years neuroscience has also been present in a relevant manner in the medicalization of medicine and in animal experimentation. It is logical, therefore, that the ethical problems linked to the nervous system (to its falling ill, to its manipulation, to its relation with other disciplines) are configuring themselves step-by-step as specific ethical dilemmas of great relevance. The ethical dimension of neuroscience flows out naturally into the bioethical subdiscipline of neuroethics.[8]

Without a doubt, in view of the rapid development of neuroscience, it is understandable that the scientific community and society in general, is ever more concerned about its possible consequences.[9] Think, for example, about medical advances such as: the new psychopharmacology, techniques of deep brain stimulation, mechanical or organic implants, advances in neuroimaging, and the early diagnosis of mental illnesses. While it is certain that science seeks the good end of understanding, modern science —the science born of modernity— seeks understanding in order to act, manipulate and dominate. Naturally, this application of knowledge has resulted in incalculable possibilities of improvement for humanity. Specifically, medicine is achieving the ability to diagnose, apply adequate and successful therapies, and even prevent ever more diseases; but unfortunately we are not lacking examples in our history —and not precisely remote— of manipulations directed towards distinct ends, towards inhuman ends: With the power of neuroscience this danger becomes enormous! The possibilities of manipulation of individuals penetrate to levels that before never would have been possible. And the consequences of these interventions are not only many times irreversible, but also quite unknown.

Now the most relevant neuroscientists are becoming aware of the fact that the questions that arise in neuroscience and in their applications exceed the laying out of a set of regulatory ethical criteria. In addition, not a few of these neuroscientists perceive with concern the further social repercussions of this research.[10] Without a doubt, "neurological research can transform in a radical way our image of the human being and consequently the foundation of our culture, the base of our ethical and political decisions".[11]

Therefore, neuroscience is not only an activity which should be controlled, but also an activity which itself questions the essence of the human being, and even questions itself as a knowledge-directed activity. We dedicate ourselves to these two points in what follows.

2.2. Ethico-anthropological Dilemmas of Foundation

In the first place, neuroscience questions the essence of the human being. In reality, every activity concerning something — and every system of corresponding ethical criteria (bioethics and neuroethics) — brings up questions that go beyond that activity as use, questions which concern the object which is being treated. It is precisely the question of why we are afraid that science will turn against man, or the act of signaling; that there is something about the human being that must be defended, which demands that we specify exactly what it is that we seek to defend in the human being, and why.

Certainly, a large part of the current scientific culture would argue that these sorts of questions that go beyond science are superfluous, precisely because science already gives —or promises to give in the future— all the answers. Nevertheless, in the current day, neuroscience is ever more conscious of its limited capacity for giving global answers; further, that all the scientific evidence combined is not

able to nullify the evidence that the subjective consciousness itself possesses concerning: freedom, identity, the consciousness of moral good and evil, responsibility, the domain of the emotions, etc. These are certainly subjective convictions, but are not less evident than the scientific data; indeed, they are more evident, because they are lived without any instrumental mediation.

In this way a set of substantive questions appear concerning fundamental suppositions about the human being. For this set of questions, various terms have been coined ("neurophilosophy"[12], "neuroanthropology"[13]....), but the most widely accepted approach today is their inclusion in the field of research of neuroethics. In this way, this discipline has two levels: that of the ethical criteria concerning the application of techniques (as a branch of bioethics), and that of the study of substantive questions concerning the human being (to which end it needs the collaboration of the human sciences: anthropology, moral philosophy, philosophical psychology, that is, philosophy in general).[14]

In other words, neuroscience appears, so to speak, as the threshold where science can no longer avoid ultimately personal and fundamental questions. This is certainly a limit, but also an opportunity to think about that which is most authentically human; this opportunity is truly possible because neuroscience has provided a new vision of science: a vision according to which the various sciences can no longer advance in an isolated fashion, but must do so in mutual contact and collaboration. It is precisely the integrating and interdisciplinary capacity of neuroscience that permits science — now more than ever— to carry on a dialogue with philosophy. The sciences should no longer confront but rather help each other, but this argument supposes that the human sciences (and philosophy as a global human science) are authentic sources of knowledge: authentic sciences. This leads to a reflection concerning science in general, concerning the possibility of a notion of science which is common to the experimental and human sciences.

2.3. Methodological Dilemmas of Scientific Activity

Reflection about science in general is, in reality, reflection about what science is, about what it is that we do when we do science, about what it means to know and to experiment, etc. This is a reflection that neuroscience has brought to the foreground because of its interdisciplinary vocation and because of the questions that it raises. But it is also an ever more urgent question today, due to the historical evolution of experimental science in general.

As is well known, the experimental sciences were born during the Renaissance. They were first undertaken in order to better understand material reality with the purpose of manipulating it; of using it to serve human necessities. For this purpose a method was developed that would achieve the measurement of results and replicate experiments: the mathematical method. A method that has the advantage of providing precise laws and models, but which loses the qualitative aspect of reality in favor of the quantitative. Nevertheless, in those days the experimental sciences — the scientists that developed them — were conscious that they were only a partial explanation of reality; an explanation that sought utility, but not the global and essential meaning of the world and of man. This holistic and integral interpretation corresponded to philosophy.

In those days, the experimental sciences had a heavy influence on the mentality of the epoch, but they exercised this influence hand-in-hand and together with philosophy. This latter was still considered as an all-embracing science, which could integrate the experimental sciences within one and the same spirit and as part of one and the same wisdom.[15] It was only in the 19th century when the positivist mentality (a philosophical conception) separated and made the sciences independent of philosophy. Positivism developed an idea of science as the only source of secure and rigorous knowledge, mistrusting all other forms of knowledge. According to this doctrine, the only form of

experience which is valid and trustworthy is sensible, measurable experience. And all other forms of experience is declared relative and illusory. Definitively, that which is knowable with certainty is just that which is sensible. This, in turn, generates a strong temptation to affirm that only that which is sensible is real. So then, this positivist mentality has installed itself in the modern and contemporary scientific conception, in good part because philosophy did not respond to this challenge as it should have.[16]

The 20th century is an exciting period of transformations in this regard. On the one hand, science itself begins to doubt its possibilities and its ideal of being absolute knowledge (with the theory of relativity and the abandonment of classical mechanicism). On the other hand, philosophy made evident —by diverse pathways, from the philosophy of science to phenomenology— two very important points in this respect. First, that science is a human activity, and as such is only understandable within the meaning and narrative context of this activity. The problem of scientific positivism is that it forgot the origin and history of science. Second, that the forms of experience are various, such that the forms of non-scientific experience can be just as evident and trustworthy as the scientific ones; that is, the criterion of truth is not quantitative measurement, but rather the evidence by which something is known.

Returning to neuroscience, these points are made very clearly manifest: In the first place, the origin and development of neuroscience is multidisciplinary, not isolated; and so is its meaning, because neuroscience does not only seek to manipulate and dominate, but rather to cure physical and mental illnesses; to understand human conduct better in order to prevent dangers and improve its protection. In the second place, neuroscience does not only work with measurable and quantifiable experience, but also with the experience of the subject who gives testimony to his or her internal subjective experiences. This is why the techniques of neuroimagery do not provide any intelligible results by themselves: the conclusions drawn from these images must depend upon the subjective experience of the patient, and depend greatly on the interpretative paradigm which is being employed. Thus, given the verification of two simultaneous facts —blood flow in determinate zones of the brain and the subjective experience of the patient— the images of this flow do not say which fact is the cause or effect of the other. Further, the experimentation carried out in laboratories depends on the isolation of variables of diverse types (social, educational, biographical ...) which are inseparable in subjective experience.[17] Thus, the techniques of neuroimaging are certainly excellent for exploring the human nervous system, but it would be quite risky to draw unitary conclusions concerning human action based solely on the results of these techniques.[18]

In conclusion, it can be stated that in the recent development of neuroscience we clearly see certain conceptual limits or ultimate questions about which it is urgent to reflect: questions about man and questions about science itself. To continue advancing in neuroscience without attending to these questions will necessarily result in dead-ends and lamentable occurrences: with regard to the human being, in the probability of committing horrors much greater than those seen in the 20th century; and with respect to science itself, in a reductionism and an empty skepticism in the face of the great questions which are always alive.

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