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MORAL INTELLIGENCE: MIND, BRAIN AND THE LAW

Fernandez Atahualpa*

Abstract: This paper discusses several issues at the impact of cognitive neuroscience have to do with the current theoretical and methodological edifice of juridical science. Localizing the brain correlates related to moral judgments, using neuroimage techniques (and also studies on brain lesions), seems to be, without doubt, one of the big events in the history of the normative social sciences. The best neuroscientific model of normative judgment available today establishes that the ethical-cerebral law operator counts on, in his neural evaluative-affective systems, a permanent presence of requirements, obligations and strategies, with a "should be" that incorporates internally rational and emotional reasons, that are constitutively integrated in all the activities at the practical, theoretical and normal levels of every process of exercising the law.

If we knew what intelligence was, either animal or human, we could perhaps undertake the task of tracking its evolution. Certainly, the previous requisite is not fulfilled. Intelligence, similarly to "mind", "thought", "will", "intention" and most of the words used to speak of the actions resulting from any human being are concepts of common sense: we use them accepting the emptiness of their meanings so that, by introspection, we are all capable of understanding what they refer to.

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* Postdoctor in Social Theory, Ethics and Economy/ Pompeu Fabra University; Doctor in Juridical, Moral and Political Philosophy /Barcelona University; Master in Juridical-Civilistic Sciences/Coimbra University; Research Scholar at the Faculty of Law/CAU- Christian-Albrechts-Universität zu Kiel-Germany; Research Scholar in Anthropology and Human Evolution at the Laboratory of Human Systematics at the University of the Baleatic Islands/Spain; Research Scholar del Center for Evolutionary Psychology / University of California, Santa Barbara; Specialist In Public Law/UFPa.; Professor Philosophy Law/ Amazonia University-Unama/PA; Honorific Collaborating Professor at the Department of Philosophy and Social Work/ University of the Baleatic Islands/Spain; Public Prosecutor – MPU/ Brazil.

They define then, a condition, a way of being and working as "human", and that the philosophers have taken centuries using the guise of a starting point to construct the ontological systems that occupy philosophical anthropology.

The technical meaning of intelligence – or of any other of the terms mentioned- is another. The author that has already studied in great depth and subtlety the human mental phenomenon searching to make a technical model of its structure, Noam Chomsky – according to Hilary Putnam -, even sustained that when we refer to these aspects of a supposed "human being" it is not possible to go further than a *folk psychology*, that is, the approximations of common sense (Chomsky, 1992). But if it is like this, then not even the starting point is well-defined. How can we advance in the phylogenetic search for something that we do not know exactly what it is?

Fortunately the cognitive sciences have come to our help. Thanks to them we count on a technical definition of "mind". The mind is a functional state of the brain, something that allows us not only to establish the brain correlates of language but also, as we shall see further on, of other mental faculties. Intelligence should be understood, therefore, as a certain kind of linking: (I) perceptive information –*inputs* – (II) elements existing in the store of memory to give sense to these perceptions and, finally, (III) motion actions – *outputs.* Put like this, the scheme seems very simple, although in fact it is not.

The model of attributing mental states to other beings to valorise their attitudes and their possible reactions to our motor responses, in other words, the so-called theory of intentional systems that the philosopher Daniel Dennet (1979; 1987) reported, indicates that certain primates among which we find ourselves – but not alone – reach very complex stages of intentional order. Little by little we are beginning to understand what the brain correlates are like of such cognitive processes.

Can we shout victory yet? Not at all. It is probable that we know how to narrow the field of intelligence/mind/brain but this does not mean we can say how it evolved.

Making a good statement and explaining it by describing how its phylogenetic transit was produced are very different proposals. It does not take much effort to accept that life began on this planet approximately 3,500 million years ago, but then very little is deduced that is an easy task to indicate how the first self- replicating molecules appeared.

Similarly, it takes no effort to accept that the human mind includes self-consciousness. Descartes himself constructed his philosophic

system from this axiomatic statement that the French philosopher considered self-evident. But to explain how the mind/brain set evolution is produced until it reaches the human capacities that we call, with great emphasis, “intelligent” – such as double articulating language, complex moral and aesthetics similar to derived traits, proper and distinctive of this form of being of the Homo sapiens supposes and raises enormous difficulties.

So much so that Richard Lewontin concluded, at the start of a text dedicated to the evolution of the mind, that: “If it were our purpose in this chapter to say what is actually known about the evolution of human cognition we could stop at the end of this sentence” (Lewontin, 1990). However, the fact that we know very little about the evolution of the human mind does not imply that speculative suggestions are lacking about how this process took place. Well, let’s examine some “evidence” to know where we are stepping when we speak of the evolution and function of our brain, our intelligence, our consciousness or our mind.

1. Operative intelligence and social intelligence: conduct interpreters

To start with, it seems that we face an enigma of considerable size. First, because there are many theories about the excessive size of our mysterious brain that, besides being evolutionarily expensive and the most complex of the objects known in the universe (in other words, known by itself), never rests, not even during sleep.

Most of the theories suggest that technological advances and tool manufacture triggered the need for large brain (Wynn, 1979; Tobias, 1987). The pressure exercised by the selection process, according to these theories, came from the physical surroundings and from other animals, sustaining that the human brain needed to be more wise than that of its predators and more apt to face the difficulties of a particularly adverse environment.

Certainly tools represented a great advantage to attack the enemy and a bigger brain could manufacture better utensils or facilitate food harvest, but then to sustain and conclude that the brain should be so exaggeratedly large as to accomplish this type of act is a very long distance. After all, if the brain complexity is a function of instrumental complexity, then the evolution models of the brain/technical intelligence set are not describing the phylogenies of intelligence but rather the evolution of the stone instruments themselves.

In consequence, it seems reasonable to suppose that something distinct motivated the increase in size of our brain architecture, since the intelligence/manufacture capacity correlation is not shown but is beyond any reasonable doubt. In truth, these doubts exist and persist. The brain tissue is, to use a good expression by Leslie Aiello, very expensive (Aiello & Wheeler, 1995). There are many biological and energetic resources that have to be invested to obtain the large brains that selective pressure imposed on *Homo*.

Thus, if the instrumental complexity is not responsible for maintaining this pressure, in other words, if the hypothesis of operative intelligence is correct, it is not sufficient by itself to justify the high cost of evolution of our brain (that most certainly it did not occur accidentally), the problem then becomes the following: to what cognitive task is to be to attributed the adaptive success of the brains that increase in size and, as we believe, in complexity, a success more than necessary to justify the increase in such a costly brain tissue?

A possible answer to this question was suggested by Nicolas Humphrey some time ago: brains become large and complicated to be able to understand the very complex rules of social living (Humphrey, 1976). With one further detail: the appearance in the phylogenies of intelligences capable of understanding such rules must have succeeded before the separation of the lines that led respectively to *Pan* and *Homo*. Nothing authorizes us to suppose that social life of the chimpanzees is simple.

It could be said then that one of the main pressures that led humans to evolve in the form in which they have were humans themselves in their social dimension. It has always been much more difficult, since the beginning, to be able to predict the behavior of the person beside you than the succession of the seasons in the year, repeated systematically throughout the centuries. The frontal cortex houses functions such as planning and decision-making that seem to be derived more from the need to interact with the members of this complex social group than the need to solve other problems related to the environment. Therefore, it is probable that the best reason for the great neocortex development in *Homo sapiens* should refer to a cognitive phenomenon linked to the recognition of the other and the valorisation of his behavior: the social intelligence.

According to Dennett´s model (1987), the strategies that maintain any individual belonging to a community in which his congeres are found or, in general, any individual A who interacts with another individual B – depend on the way A considers that his own conduct will influence what B does. The calculations can get as complicated in the comings and

goings of the expectations as those of a chess player anticipating the moves. It is clear, then, that if some primates can assess the world and their role in it in this way, the amounts of intelligence that they need regarding these cognitive tasks are considerable.

The concept of *Machiavellian intelligence* intends to express the range of cognitive processes necessary for every species that reached the intentional system of the third order proposed by Dennett, where the individual A will attribute to the other individual B with whom he interacts the possession of a fairly complex mind serving to harbor desires and beliefs about himself. In this way, it is supposed that A will act in the least way possible to ensure that B interprets his conduct – that of A – in the way that A prefers. We are social actors, would be the conclusion, and we want to manipulate others. But: who are these "us"? Only human beings? The set of humans and chimpanzees?

The brother group of the *Pan+Homo* set, in other words, the gorilla genus is the biological group most closely related to us and chimpanzees. The gorillas maintain social groups with a dominant male, several females and the corresponding offspring, so it seems that they would need a similar Machiavellian intelligence level. The orangutans, *Pongo*, are on the contrary, solitary animals regarding the males. However, establishing the boundary of greater intelligence there seems to be a little inadequate. Sarah Brosnan and Frans de Waal indicated by a very elegant experiment how the capuchin monkeys, *Cebus apella*, have a sharp sense of justice.

Under experimental conditions, the monkeys learn to exchange counters for food with a human keeper but they refuse to do it if the treatment they are offered is worse than that offered to the monkey whose exchange they see and assess (Brosnan & De Waal,2003). The discovery that the capuchin monkeys are disposed to exchange counters for food but only when the treatment is similar to that given to other individuals in the group opens a wide field of possibilities for study that can be perfectly related to the ideas of the ethologists and psychologists (such as Humphrey, 1976) regarding the "why" of the appearance of large brains in primates.

Indeed, a conduct of this style shows something that another interesting fact about the emotive component of intelligence and its weight in our decision taking processes and actions. We face the fact, for example, that it will soon be time to change the mathematical models that describe human behavior in terms of calculation and decision and introduce the emotional variable. But at the moment we do not know how to do it, probably because it does not seem possible to

say that we know so much about the way our brains relate sentiments and judgments.

2. Mental modularity

How do they do it? One of the most complex and most interesting aspects for any investigation to study the functions of the human brain is its modular character. The idea of that a mind is modular implies that the mental processes are in some compartment form already from the moment of the birth, that is to say, that exist innate structures that define certain authorities specializing in the brain by means of which one is going to produce the knowledge. This way, mental modularity implies a structure in which different thought systems or neuronal networks are integrated that link diverse brain zones. Chomsky speaks of several "mental organs" that develop each on in a specific way according to the genetic program, in the same way as in the development of the other organs of the body (Chomsky, 1980). Indeed, the most decided and finished hypothetical proposal, about the existence of brain modules in charge of processing certain mental functions, was carried out within the so-called "cognitive functionalism" by Fodor and Chomsky.

When the great differences that the modular theory raises by different authors are considered (Cela Conde & Marty, 1998), the main common points to consider for the effects of this article are: (1) the mind is a functional state of the brain (something that implies denying any dualism that, such as the Cartesian, give the mind an ontological statute separate from the biological, and independent from the biology of the brain); (2) the brain events that lead to the mental functions do so by computational processes (there are based, then, on the activated or deactivated state of the basic elements that interconnect: the neurons); (3) each cognitive function can be considered a module of our mental architecture (the equivalent of an organ whose dominion is specific: language, numerical capacity, etc.); (4) the modules function from the mostly innate brain components (although they need environmental elements to arrive, during the ontogenesis of the individual, at the maturity of the mental organs).

Mental modularity has been understood in many ways, as we said, by different authors of computational functionalism. The most interesting proposal for our purposes is that of Noam Chomsky, for two reasons. First, his cognitive architecture is compatible in great part with the discoveries of the neurosciences. Second, closely related with first, is that there are some empirical descriptions about the neuronal

components of these mental organs. But before entering into details it seems interesting to consider a crucial aspect: the interaction among the brain processes and the formed environment, which in our species refers to a group in close social living.

Let us consider a very well known mental function: that of language. The Chomsky model of development of the linguistic competence passes through the presence of the genetic components of human nature of some capacities that give any newborn baby the possibility of developing a certain language. These components have to be as powerful and complete as to permit that the creating of a language of great syntactic and semantic precision takes place in a very short time – a few years – and without a specific teaching program. But the innate components cannot be so wide as to impose the grammar of a particular language. Any child, of whatever ethnic group, will learn the language of the group in which he grows up in. The social dimension of language imposes, then, its rules.

Can the same model of competence development be extended to other mental modules/organs? The answer appears to be affirmative. The brain reaches maturity during ontogenesis also like any other mental module or "organ", and not only that of language. It seems reasonable to admit, therefore, that our valorisations are, on the whole, the result of two dominions in a permanent state of interaction: (A) a set of genetic determinations that stimulates us to maintain moral attitudes, to assess and prefer, and that belong to the genome common to our species; and (B) a set of moral values of the group that is a cultural construction, so that the said construction (and the transmission) of the values has a place historically in each society and each era.

The universe of preferences resulting from the interaction is not free to take any path. Our valorisations are largely determined by the innate tendency to determined behaviors, that can be considered the true source of human values. And it seems important to give this circumstance value because the shared moral and juridical valorisations are those that are most likely to be successful in the context of an essentially social existence, most particularly at the time of creating and fitting the ethical and normative precepts.

As Damasio (2001) sustains, the ethical values constitute acquired strategies for survival of individuals of our species, but such acquired skills find a neurophysiological support in the neuronal base systems that execute the instinctive behaviors. The brain processes that have a relationship with the emotions are deeply articulated with those that carry out assessment calculations, by the establishment of neuron

networks that connect the front lobe with the limbic system. Thus if moral and ethical-juridical judgment is based on reasoning that causes assessment calculations and also on emotions and moral sentiments produced by the brain, they cannot be considered as totally independent of the constitution and functioning of this organ whose genesis and acquisition should then be re-integrated in the evolutionary history of our species.

We follow, then, along this line. The traits that, in addition to language, best distinguish human beings from other primates are moral judgment, aesthetics and religious beliefs – to leave to one side other notorious traits such as musical sense. Indeed, the two first already have experimental evidence on which of the brain correlates of the cognitive processes underlie ethics and aesthetics. We are dealing here with correlates that in the brain seem to dictate the sense of moral behavior and justice, relating and defining the possible implications of this evidence with the current methodological problem of juridical interpretation.

3. The organ of moral I : judgment processes

The best confirmation of the role that emotion plays when any human being is faced with problems regarding moral dilemmas and the processes of decision taking came through investigations carried out by cognitive neuroscience.

Since Hanna Damasio and his collaborators resuscitated the Phinease Gage case, the engineer who, in the 19th century, suffered brain lesions that did not kill him but did ruin his life because they caused deficits in his decision taking process (1994), the importance has been shown of the cerebral connections between the frontal cortex and the limbic system that can lead to useful conduct in terms of social adaptation (such as the subtle expression of the type of intelligence specific to our species, the so-called “somatic marker hypothesis”). Study of patients with brain lesions has established that the amygdala and other zones of the brain are necessary elements when making judgments on social life, although their respective roles are different in this process (Adolphs, Tranel & Damasio, 1998; Bechara et al. 1999).

For their part, and thanks to the functional magnetic resonance technique (fMRI) that measures oxygen consumption caused by the work of the neurons, Alan Sanfey and his collaborators (2003) identified in subjects, this time healthy, the activation of the zone that is related to the emotions – the anterior insula - and another frontal zone with

multiple functions including the making of judgments in the face of the alternatives existing for the action – the dorsolateral prefrontal cortex.

The fact is assumed in all these studies that the brain is the generator, by its functional states, of what we call conscience or mind. Indeed it could not be otherwise: as we were saying initially , few ones deny today that the mind is a functional state of the brain. But there is a considerable difference between talking about brain activity in vague terms and establishing which are the interrelated neuron networks in a determined cognitive process. Unfortunately, the temporal precision of fMRI is not very high, between two and six seconds, while the brain activation processes are measured in milliseconds.

In this respect, thus, what do fMRI and positron emission tomography (PET) indicate to us about brain activation related to judgments that imply in a certain way the use of moral values?

The results of different studies are rather disperse due probably to the different objectives and starting points of the different groups of investigators, that leads to questioning of the validity and suitability of some of the experimental designs that have been used as a base.

The study by Joshua Greene and collaborates (2001) is centred on the search for differential neuron correlates to resolve two different groups of dilemmas that are distinguished by the way of arriving at the same result. The paradigmatic examples about the two different types of moral judgment were the following: one where the subjects finds themselves personally implicated in a certain action (*footbridge*) and another that implies a greater personal distance from who judges the action (*trolly*). Greene et al. called the first "moral-personal dilemma" and the second "moral-impersonal dilemma" but it is rather doubtful that these denominations are effectively the most suitable or correct.

In the first case, the moral impersonal dilemma, the participant in the experiment is placed before the following situation: ***trolley* type dilemma** – a runaway train will kill five people if it continues on the same track. One subject, situated in a location far from the facts, can, by simply moving a lever, detour the train to the other tracks where there is only one person, who the vehicle will kill without a doubt. Is it correct to action the lever?

In the second case (***footbridge* type dilemma**), of moral personal judgment, the guide and love follows a similar pattern, with the difference that now the subject is placed on a bridge over a railway line and has a stranger beside him. To save the five people that will be run over, the subject can push the stranger over the bridge onto the railway tracks, who will certainly die, thus stopping the train. Is it correct to act in this way?.

The search for different neuronal correlates originated because the responses to the dilemmas from the different subjects included in the experiment varied substantially. In brief, most of the participants would respond that in the first case it is appropriate to detour the train sending it in the direction the solitary individual, while in the second case, the majority also thought that was not appropriate to throw the stranger to the railroad. All this makes it obvious that the final result of both dilemmas is the same: save the life of five people in exchange for the life of a single individual.

To continue the study Greene´s team added to the *trolley* type dilemma groups -that he called moral-impersonal dilemmas, and to the *footbridge* type - or personal-moral dilemma – a third group of neutral dilemmas to serve as a baseline to compare the results of the other two. The heuristics used for construction were from the paradigmatic dilemmas and creative variations on them, a process by which he established that the personal dilemmas should necessarily contain three elements 1) imply bodily damage; 2) to an individual or a particular group of individuals and 3) so that the damage is not a "deviation" of a pre-existing damage, but rather the result of the express intervention by who judges (agency notion). The dilemmas that do not have at least one of the previous elements would be considered impersonal, to contain moral judgments, or neutral if they referred to another type of judgment such as using a one type of ingredients in a pie recipe that calls for others.

The interesting thing is not so much the response of the experiment participants but rather the brain zones that were activated differently when they faced moral personal dilemmas, moral impersonal dilemmas and dilemmas with no moral content. According to the results obtained by Greene and collaborators (2001), the personal condition (*footbridge*) activated significantly more the medial frontal gyrus (Brodmann´s areas – BA – 9 and 10) and the posterior cingulate gyrus (BA 31) and the angular gyrus turn in the two hemispheres (BA 39). All these areas are considered related to the processing of the emotions.

On the contrary, the moral-impersonal dilemmas (*trolley*) and the morally neutral dilemmas activated significantly more the middle frontal gyrus, right (BA 46) and the parietal lobe of both hemispheres (BA 7/40) that are areas related to work memory. The results therefore indicated an implication of the emotions in the judgment on personal dilemmas in the face of the calculation present in the impersonal and neutral dilemmas. The original study by Greene and collaborators was later widened (Greene et al. 2004) including this time the individuals´ responses to the personal dilemmas was no significantly different.

Some shadows can be found in the interpretation of the experimental design by Greene and collaborators (2001). In the first place, the judgment neuron correlates associated to the moral impersonal and neutral dilemmas were in practice identical with the exception of some points in area BA 7/20 of the right hemisphere. To complete, the key point where it might have been possible to search for additional differences, the orbitofrontal cortex, could not be studied due to certain artefacts created by magnetic susceptibility. But there are also some doubts about concept. Although the subjects in experiments opted for a distinct solution in the case of the lever and the bridge, it is more doubtful, as the authors themselves suggest, in another part, at the end of that article that the action can be called impersonal when they are obliged to sacrifice one person, and even more suspicious that these impersonal actions activated the same circuits in the brain that the non-moral judgments in the same way as it is correct use common nuts in a recipe created for macadamia nuts. Either human intelligence hides certain traits of perversity and indifference regarding the luck of our congeres, or the experiments shows different mental keys to a moral judgment.

A study by Jorge Moll and collaborators (2002) offered some hints about this using dilemmas that implied moral judgments (example: the judge condemned an innocent person), neutral non-moral judgments (obese children should go on diets), non-moral but disagreeable judgments (he cleaned the lavatory with his tongue) and senseless judgments (the vital term of the drunk shoes was brother). The moral judgments activated the orbitofrontal medial cortex, the temporal pole and the upper temporal groove of the left hemisphere while the non-moral but disagreeable judgments activated the left amygdala, the lingual gyrus and the lateral orbital gyrus.

In the opinion of the authors, the coincidence in this last case with the zones that Greene and collaborators indicated as belonging to the personal moral judgments points to the activation of emotive zones not so much by the need to decide the morality of an action as by the disagreeable circumstances of the conducts that arose in the experiment, evidently important at the time of pushing the person from the bridge. Referring to the activation linked to moral judgment, the study by Moll and collaborators confirmed issues already known such as the implication of the orbital frontal medial cortex. But the fact that the moral judgments did not activate limbic zones but rather occipital zones related to vision shows the need to carry out new experiments with more subjects under more controlled conditions.

4. The organ of moral II: brain and the Law

Localizing the brain correlates related to moral judgments, using neuroimage techniques (and also studies on brain lesions), seems to be, without doubt, one of the big events in the history of the normative social sciences. Indeed as neuroscience allows an ever more sophisticated understanding of the brain, the possible moral, juridical and social implications of these advances in the knowledge of our sophisticated ontogenetic cognitive program begin to be seriously considered under a much more empirical light and with respect for scientific methods. The object would be, in principle, the intention to clarify the location of high cognitive functions understood as *Homo sapiens* apomorphisms of the capacity to elaborate moral judgments.

But there is no doubt that, from the evidence obtained, we can go much further. These advances, however, in addition to their extraordinary scientific relevance, also carry important philosophical, juridical and moral connotations, particularly regarding the understanding of the superior cognitive processes related to ethical juridical judgments, which are understood as functional states of brain processes. It starts from the conviction that, to understand this essential part of the ethical juridical universe, it is necessary to go inside the brain, to the brain substrates responsible for our moral judgment and whose genesis and functioning it's necessary to place in the evolutionary history of our species.

And although cognitive neuroscience research into moral judgments and normative judgment in law and in justice is still at a very early stage, its use seems to be undoubted. With one condition: that in an area as delicate as that of neuroscientific investigation, results should be considered with great caution. Because science, that certainly will serve to ensure more knowledge about human nature, will not be able to guarantee, by itself, moral values as they can be a greater respect to human life, equality and liberty.

This is perhaps the reason why questions and philosophic and moral doubts abound in the crossover area between neuroscience and law: we are in the case of moral judgment or other similar perceptive phenomena, before much more unitary and discreet cognitive processes, or are they only phenomena that emerged from many psychological mechanisms articulated in time and space? Are these dead processes or a series of processes that have some aspect of universal character, in the sense that they have some common nuclear component capable of determining in each individual his particular valorization of what is or is

not just? Will it be possible some day to describe this process or processes (or their key components) in more objective terms? Should their origin be sought in some idiosyncratic pattern of neuroactivity that contains at least some identifiable time sequences shared by all the individuals? Unlike what seems to occur in the neural base of the artistic faculties (Changeux, 1994; Vigouroux, 1992) , there are some neural areas whose specific intervention is in a certain way critical and universal in the mark of the widely distributed activity that a very probably subjugates – as in all the and superior cognitive program services (Vigouroux, 1992) – to the phenomenon of the moral experience? How much do the heredity and learning history of each individual contribute to starting or activating of this supposed functional pattern? Can the modern neuroimage techniques be useful not only to locate the brain seat of such an activity trait, if only, but also, to identify the differential implication of certain distributed circuits?

Especially regarding the juridical phenomenon (therefore in that refers to his ontological aspect as methodological of interpretation and application of the law) the problem of localizing the brain correlates that dictate the sense of justice raises the following questions: what is the relationship between the results of neuroscientific investigation on moral and juridical cognition and the theoretical perspectives of the law? At what point can it be linked confidently and so decisively so that cognitive neuroscience questions the results of juridical comprehension and exercise? How can a neuroscientific model of normative judgment in law and in Justice offer powerful reasons that could come to account for the subjacent falsity to the common conceptions of human psychology (and rationality)? How much does this neuroscientific perspective have to do with the current theoretical and methodological edifice of juridical science? Or, as we are, how will it change our conception about Man regarding the cause and purpose of law and, consequently regarding the task of the jurist-interpreter to give “hermeneutic life” to positive law?

Well, one of the most common fetishes of current juridical science, inherited from the traditional concept of the juridical method that aims to rescue the values of juridical order, truth and security, is to ensure that the judges should limit themselves to applying to individual cases the general norms to cases dictated by the legislator, following a formal process of logical and subjective deduction. It is a merely descriptive operation, cognoscitive of a previously established and “reproductive” norm of the legislator’s will (who has the exclusive responsibilities of the axiological and normative intentions established in the laws). Such an operation, starting from the supposition of emotional neutrality, of the

rationality and objectivity of the interpreter, reduces the judge to a mere technician in applying the mechanisms of the law, as the responsible for the search (or simple knowledge) of his will, as the description, that can be true or false, of its prior and pre-existing authentic significance to the interpretive activity itself.

Indeed, all the hermeneutic construction and the unit itself of the realization of the law elaborated by the contemporary theories assume, nowadays, the dominant way of explanation of the theory of rational choice, constructing a rational image from what seems to be, in itself, irrational. Its fundamental concept is that, above all else, the judges are essentially rational and objective in their value judgments about the justice of the decision: they examine as well as they can the facts pertinent to the case and ponder, always neutrally and without emotion, the probable results that would follow from each of the potential choices. The preferred ("just") option is that the best fits the criteria of rationality and objectivity by which it was generated.

The indicated analysis process contains, in essence, an operation incompatible with the knowledge accrued by neuroscience. That is constructing a model of extreme rationality (of the judge's decision) from something that is configured essentially as an activity with accentuated irrational components.

The inadequate of the image sets of manifest to analyse how the brain functions when we formulate moral judgments about the just or unjust. Because of the cerebral associate processes, it is necessary to accept of the undoubted presence of illogical elements and, in general, from (intrusion) the values in juridical reasoning. From there, they already do not consider acceptable or legitimate the fact of continuing considering the hermeneutic task as an operation or set of operations ruled exclusively by deductive or cognitive syllogism. Indeed, the human mind seems to be full of traits and defects in design that cover up our biological inheritance regarding full objectivity and cognitive rationality.

The most influential theorists of positive law from the last century (especially Kelsen, but also Hart, with the necessary backgrounds) do not offer us a theory of application of the law, but rather limit themselves to considering that where there is no mechanical application or subjection we should speak discretion in a strong sense, in other words, of the creative activity of the law, understanding this to be an act of discretionary will in which reason appears in a merely instrumental condition. For Kelsen, for example, every act of interpretation is of voluntary, and not cognitive, nature. From this one understands that the active "application" of the law consists in reality of an authentic

decision, a constructive act and not merely a declarative act, similarly to what happens with the acts of the legislator.

Furthermore, not only are the majority of judicial decisions taken with relative speed, in complex scenarios and with partial and incomplete information and even under conditions of uncertainty - as the judges - in the process of exercising the law, do not stop being human beings imbued with every ethical concern, with certain values, preferences and moral intuitions, so that it does not seem legitimate or reasonable to interpose, in the application of the law, an impassable barrier between the desired objectivity and the emotional subjectivity of the interpreter. The process of exercise the law on the part of the judge implies, in the last analysis, a task that can be considered constructive and emotional, personal and creative in a certain sense, although not absolutely free or without links to the judge.

Indeed, a single solution cannot be spoken of, a single correct response, meaning precisely that who applies the law can choose among various possible solutions, all of them correct, in other words, all of them derivable from the norms that integrate the juridical system and following the procedure established in it. And if it is thus, if several correct solutions or responses are possible for the same juridical problem, the final choice, necessarily unique, is then presented as not derived exclusively from the system, circumstance that immediately raises at least three basic questions: of epistemological order, of axiological-political order and of subjective-individual order of the jurist interpreter.

And it is this finding that makes not only the notion of habitual rationality in juridical science the objective of drastic revisions, but the same idea that juridical science is founded on objectivity, neutrality and rationality of the operator of the law has been assaulted recently from all directions. Soon, starting from some tendencies in philosophy and in philosophy of law, but also, and maybe more incisively and strongly, on the part of the cognitive scientists, of the philosophers of the mind and the advances from cognitive neuroscience. And with the result that, although when some notion of rationality in the process of exercising the law seem undoubtful (to accept the idea that intentionality is not required a task previously condemned to failure), the process of value derivation is not of a basically neutral, objective or rational nature.

If it is certain that moral choice cannot exist without reason (individual preferences and instrumental reason), it is no less certain that “intuition” (and already now the " empirical evidence ") is the characteristic human range of emotions that produces the proposals, goals, objectives, wants, needs, desires, fears, empathy, aversions and

the ability to feel other people's pain and suffering. We formulate moral judgments on the just and unjust not only because we are capable of reason (as expressed in the game theory and the juridical interpretation theory) but, rather, because we are equipped with certain innate moral intuitions and emotional stimuli that characterize human sensitivity and allow us to connect potentially with all other human beings.

Definitely, due to the fact that the evolutionary pressure did not increase (in an "optimal" way) human rationality, any construction of a juridical theory of exercising the law should imply a re-dimensioning of the psycho-biological understanding of the access to reason itself. In particular, it should start by rejecting of any conception about rationality objectivity and neutrality caused by ignorance of the functioning of our brain - especially with the experimental evidences related to the brain correlates that intervene in the cognitive process of forming moral judgments to decide between the just or the unjust.

In other words, if the last factor of individualization of the response or conclusion of the juridical reasoning does not proceed from the juridical system (although it should be compatible with it), it seems obvious that the personal convictions of the operator of the law must take precedence. And because for hermeneutics the subject-object model is not viable in the human science ambience, the subjectivity present in every act of understanding, interpretation and juridical application should be approached by analysis of the brain processes of the law operator. Paraphrasing the warning by Philip Tobias (1997) regarding language, judgment is a brain activity.

Thus the ethical juridical judgment based not only on reasoning but also on emotions and moral sentiments produced by the brain cannot be considered as totally independent from the constitution and functioning of this organ that, in a first analyses, seems not to have a single and differentiated head centres for moral cognition. The best neuroscientific model of normative judgment available today establishes that the ethical-cerebral law operator counts on, in his neural evaluative-affective systems, a permanent presence of requirements, obligations and strategies, with a "should be" that incorporates internally rational and emotional reasons, that are constitutively integrated in all the activities at the practical, theoretical and normal levels of every process of exercising the law.

Indeed, since already we made see, the neuroscientific model of normative judgment in the law and justice seems to suggest that juridical reasoning implies a wide recruiting and use of different systems of mental skills (related both to rational and emotional thought) and various information sources (Goodenough & Prehn, 2005). It is the

coordinated and integrated activity of various brain structures that makes human moral conduct possible, that is, that moral judgment integrates the frontal regions of the brain with other centres, in a processes that implies emotion and intuition as fundamental components. And further, that each one of these brain functions intervenes in a wide diversity of cognitive operations, some related with social intelligence and others not (Green et alii 2001 and 2002; Moll et alii, 2002 and 2003).

It seems beyond doubt the fact that the investigations in cognitive neuroscience of the moral, and a very especially of the normative judgment in Law and Justice, may provide an enormous and rich contribution to the detailed understanding of the internal functioning of the human brain in the act of judging – of forming moral judgments about the just and the unjust. Neuroscience may subminister the necessary evidence about the nature of the brain zones activated and the brain stimuli implied in the decision process, on the degree of personal involvement of the judges and the cultural conditioning in each concrete case, and also on the limits of rationality and the degree of influence of the emotions and the human sentiments in the formulation and conception about the "best decision".

Without forgetting of course, other distinctive aspects of the nature of human behavior at the time of deciding on the sense of concrete justice and the existence of a moral universe determined by the biological nature of our cognitive (neuronal) architecture. After all it is the brain that allows us to have a moral sense, that gives us the necessary skills to live in society and solve certain social conflicts and that serves as a base for the most sophisticated philosophical discussions and reflections on rights, duties, injustice and morality.

5. Project to near the neuroscientific implications linked to the problem of the interpretation and application of the Law

In the Human Systematic Laboratory at the University of the Balearic Islands, we are developing a research project to identify the brain areas activated (MEG and fMRI) during judgment tasks in magistrate professionals and non-professionals.

The project consists of identifying the brain circuits that are activated when we carry out some types of judgment. In concrete terms, our objective consists of studying the judgments of juridical nature and contrasting them with those of purely moral nature, the latter without

juridical consideration. Additionally, we intend to compare the brain activity of magistrate professionals and people unrelated with this profession when performing these judgments. The following questions will be addressed: (I) whether "easy" and "difficult" ("hard cases") judgments activate the same brain processes; (II) whether brain circuits activated by magistrate professionals are the same or similar to those activated by other citizens; and (III) whether the activation of those brain circuits coincides during ethical juridical, moral judgments and judgments without juridical weight..

The localization of neural nets involved in these judgments will be carried out by means of magnetoencephalography (MEG) and functional magnetic resonance imaging (fMRI), with the objective of accurately establishing temporal and spatial patterns. The project is related with two other ones. The first, carried out through 2000-2003, investigated some evolutionary keys of language, as well as moral and aesthetic judgments. The second, obtained in 2003, was aimed at analyzing brain activation during aesthetic judgments with greater precision (Cela-Conde et al., 2004). In this project, the study of the activation of brain circuits during moral judgment tasks will be undertaken. A special emphasis will be placed on ethical juridical judgments and on the professional experience of magistrates as a possible source of differences.

The central idea is that the proposed experiments permit, in the first place, to know that neuron circuits intervene in judgment processes, both juridical and purely moral judgments, both in the easy and difficult cases, all this in participants without clinically diagnosed disturbances. We will thus realize a localization that permits not only the establishment of spatial lines but also their time distribution, that is enormously important when understanding cognitive functions (Barteks & Zeki, 2004). In the second place, to understand how much the magistrate professionals use the same judgment cognitive processes as the citizens without judicial responsibilities.

It also permits the definition of whether in the act of judging (specially in the called ones "hard cases") the answers to the dilemmas by the different subjects participating in the experiment vary substantially, most particularly regarding the activities undertaken by magistrates belonging to a Tribunal (in 2º jurisdiction) and by judges who exercise the jurisdictional activity in the first degree of jurisdiction (in the first instance). In this sense, it seems reasonable to assume that, in the first case (of judges belonging to the Tribunal), the neuronal correlates activated in the active judging are the same as found in the ***trolley* type dilemma** (that implies a greater personal distance for

who is judging the action), and that the magistrates, placed in a position far from the parties and the concrete facts, intervene in a non-arbitrary and *impersonal* way in the life plans of the individuals involved in the lawsuit.

On the other hand, in the case of judges of first instance, the neuron correlates activated in the act of judging may be the same as those found in the ***footbridge* type dilemma** (that implies a greater personal proximity with the juxtaposed interests), since, because they are in direct contact with the parties and concrete facts, the non-arbitrary form of intervention implies a *personal judgment* in the act of intervening in the life plans of the individuals involved in the lawsuit. Thus it is obvious that the final result of both cases is the same: applying the law to a concrete case, intervening of institutional and non-arbitrarily form in the life plans of the people involved in a certain conflict of interest.

Finally, it will permit us to identify the role that rationality and emotion play in the act of judging and, from then onwards, design a methodological model more suitable for the task of lawyer-interpreter in giving hermeneutic life to the positive law.

6. Looking at the present

The design of the brain that is appearing thanks to studies of cerebral engineering points to some ideas worth mentioning. Firstly, the confirmation of those hypothesis proposed by Crick and Koch (1990) about conscience as a synchronized activity of neurons that are found situated in different places in the cerebral cortex, that puts in doubt some of the more firm ideas of computational functionalism and the strict concept of the supposed modularity of the cognitive processes (Fodor, 1983), as for example: of one central processor and a bottom-up progress of perception until it reaches the superior processes.

In what we call “knowledge”, complex activation sequences intervene whose spatial and above all temporal dimensions could not be shown until the development of techniques as precise as magnetic encephalography, capable of detecting the neuron activation in lapses of hundredths of a second.

On the other hand, the neuronal characterization of the moral does seem compatible with an evolutionist psychology that understands that the same cognitive processes intervene in different tasks or to solve different problems (Schapiro & Epstein, 1998).

Especially regarding the law , the neuroscientific investigation of moral and juridical cognition has, in a certain way, revolutionized our understanding about the nature of thought and human behavior, with profound consequences that may affect the domain itself (ontological and methodological) of the juridical phenomenon. And as there seems to be no human institution more fundamental than the juridical norm and, in the field of scientific process, nothing more fascinating than the study of the brain, the union as these two elements (norm/brain) ends up representing a naturally fascinating and stimulating combination, since the juridical norm (its interpretation and application) and the behavior that seeks to regulate it are both products of mental processes.

It is also precipitate to think that the first neuroscientific investigations about moral and normative judgment already open the door to a better humanity. I fear that this would be to simplify things to extremes. Thus as ingenious creationism can condemn human beings to a permanent minority age, thus also an incomplete neuroscientific model can lead us to conceive incorrect illusions. Because it is not absolutely certain that more and better knowledge of the neuronal conditioners of humans will automatically give us a more dignified human life. If only things were so simple!

To think that the brain/moral/law relationship is everything can lead us to forget that the measure of the law, the idea in essence of the law, is human whose nature results not only from a very complicated mix of genes and neurons but also from experiences, values, learning and influences from our equally complicated social and cultural life.

The mystery of man consists precisely in warning that each person is a secret to himself. Neuroscience will help us to understand a series of elements that form the mystery, but they will not completely eliminate it.

Thus, assuming the mystery will always remain, science may lead us to understand better that the search for an adequate methodological criterion to understand and realize the law can be considered, above all, as the archaeology of these structures and brain correlates related to the processing of ethical juridical information.

It could even help us to understand that the hermeneutic activity is formulated precisely from an anthropological position and triggers the phenomenal energy of human action; that only from the point of view of the human being and from his nature can the judge represent the sense and the function of the law as a unit in a vital, ethical and cultural context. This context establishes that human beings live the representations and meanings designed for corporation, dialogue and argumentation and processed in their brain structures. That in their

"exist with" and situated on a certain historical existential horizon, members of humanity continuously complain about others, whose changeability is accepted, that justifies their choices bringing the reasons that subject and motivate them.

We are still far from a precise map of the spatial temporal activations related to the cognitive processes but it seems that we are on the right track to begin to map and understand them. We know already, for example, that in the task of accomplishment of moral judgments it is essential the connection between the frontal cortex and the limbic system (Damasio,1994; Adolphs et al, 1998; Greene et alii,2001 e 2002; Moll et alii, 2002 e 2003; Goodenough & Prehn,2005). We know that the aesthetic perception implies the activation of the left prefrontal cortex (Cela-Conde et al, 2004) . We know how the processing of the color is realized from the visual primary centers of the occipital cortex (Zeki & Marini, 1998; Bartels & Zeki, 1999), as well as the neuronal activation related to the identification of objects perceived by means of the sight (Heekeren, Marrett, Bandettini & Ungerleider, 2004) .In general terms, a panorama is appearing where the prefrontal cortex plays a primary role regarding the superior cognitive processes, something that had already been suggested, although its was a speculative hypothesis, by the pale anthropologists (Deacon, 1996; 1997).

Whatever it may be, and even if we do not know much about the functioning of the brain, and very especially the brain correlates that dictate the sense of moral and justice, converting this sea of speculations into certainty is definitely a task that is expected of science, in the precise sense that a deeper understanding of the ultimate causes (rooted in our nature) of human moral and juridical behavior could be very useful to ascertain what are the possible limits and conditions of ethics and the law in the context of contemporary societies, as well of the evolutionary way that has given place to the nature and to the human morality.

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