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Atheistic and Religious Brains

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Recent hostilities between evolutionary biology and theistic movements are used as an entrance into the neurobiology of religiosity and non-religious agnosticism and atheism. Several frontiers of neuroanatomical and neurophysiological research are briefly discussed selecting those findings which appear more promising to anchor the neural substrates of spirituality, transcendence and nonreligious disbelief within specific neural circuits and networks. This is a long-range endeavour which has only started a challenging itinerary though it may offer more substantial fruits than the perennial doctrinal clashes across the hiatus (negligible, in a lot of minds) between science and faith.

Keywords: Religiosity, Spirituality, Transcendence, Atheism, Brain, Neuroimage

Cerebros ateos y religiosos

Las hostilidades que se han prodigado, últimamente, entre la biología evolutiva y diversos frentes teístas sirven de antesala para una incursión a la neurología de la religiosidad y del pragmatismo agnóstico o las convicciones ateas. Se revisan diversas sendas de indagación neuroanatómica y neurofisiológica que han comenzado a aportar datos firmes para anclar las proclividades religiosas y las propensiones descreídas en circuitos y engranajes singulares del encéfalo. Se concluye que esa es una empresa de gran calado que tan sólo ha iniciado su desafiante recorrido, aunque es probable que ofrezca frutos mucho más sustantivos que la reiteración de debates doctrinales en el hiato insalvable (aunque perfectamente compatible, en un mismo cerebro), entre ciencia y fe.

Palabras clave: Religiosidad, Espiritualidad, Transcendencia, Ateísmo, Cerebro, Neuroimagen

ATHEISTIC BUSES AGAINST RELIGIOUS MEMES

In 2006, Richard Dawkins¹ and Daniel Dennet² simultaneously began a strong antireligious campaign from the unbelieving ranks of biology. With a much more combative attitude by Dawkins and scholarly detached by Dennet, the duet united forces together with outstanding activists of the secularism rooted in science³ to sever the initiative of the religious resurgence in the cultural panorama of our era. Besides books, discussions in internet forums and tours of conferences on one side or the other of the Atlantic, they sponsored publicity campaigns of different types with not unimportant impact, although that which left a longer lasting trail was that of the "*atheist bus*" that circulated through some of the most important cities of the planet. The full understanding between these two leaders of antireligious thinking should not be surprising, because some years earlier Dennett⁴ had already put forth a thesis on the nature of the religion that gravitated on the notion of memetic transmission of Dawkins.⁵

In spite of his neodarwinian radicalism, Dawkins has always defended that in order to decipher the origins of religiousness, the flexible processes of cultural transmission (imitation and early instruction in children, and the training of habits, persuasion and seduction) are much more important than the chromosomal filters that open the way to natural selection or to sexual selection. Thus, the proposal of infective "*meme*" (*functional units of the cultural replication*), for the dissemination of the religious ideologies. God, the Gods, or any notion related with the sacred, constitute, according to this, ideation artifacts having great invasiveness with a specific function: to promote order and stability in the very complex surroundings where the humans should resist and prosper. The essential scripts of all religion (the "*nuclear memes*," according to this hypothesis), contain a simplified but coherent description of the world that facilitates its understanding and meaning. They serve, definitively, to construct *bastions of confidence* that have the guarantee of the supreme authority. The religious beliefs would be, consequently, cognitive spells at the service of the

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expectancy in a comforting regularity. From this, its contribution to the tuning and fraternity between the members of the devotional community is derived. This *leverage of safety* is the essential attribute shared by all the sacred narratives, whether from the monotheistic or polytheistic religious traditions or, on the contrary, from "secular" assumptions (philosophical or scientific) on the ordered essence, although unreachable for the human periscopes, of the universe and its phenomena.²

To brace the memetic conjecture of the genesis of the religions, Dennett used biological requirements for these ideational typologies,⁷⁻⁹ although his approach is orthodox: according to him, religions are *"social systems whose participants avow beliefs in a supernatural agent or agents to whom they owe obedience and respect."* The core of the definition therefore lies in the belief, in the conviction that there is a higher authority that actively regulates the future of existence. Religion is summarized in the belief, in the faith in agents or omniscient and all-powerful vectors. In turn, the sum of individuals with a shared belief shapes the devotional social system. By this dissection, Dennett avoids all need to deeply cope with the experiential¹⁰ and temperamental¹¹ elements of religiousness (transcendence, spirituality, harmony, serenity, compassion, meekness, submission, credulity, empathic communion), in order to concentrate on the cognitive core of the subject. He needs to do it in this way to involve, without difficulties, the memetic speculation: the notion of the cognitive, contagious and long-lasting device. However, with this, he rules out (or only touches upon the topic), neurobiological or genetic incursions that have already been made into the affective/emotional attributes of religiousness and their variability based on temperamental typologies.^{12, 13}

The result of this elimination, which Dennett fully shares with Dawkins, is, in my view, disappointing. They continue to use memetic conjectures for the cultural replication that move in a speculative setting and that besides being insufficient to substantiate the genesis of the religiousness, they also do not approach the origin of the "atheist meme," agnostic or the irreverent. Phenotypal varieties that also thrive, by the way, in the world (although much less, to tell the truth). On the other hand, when they arrive to the sphere of the shared belief (the shelter of the social convention and uniting ideology), they liquidate the question promptly to go into the details of the representational stage (the belief in the belief in God), as a means of connection to explain the power of religious meme.² The problem is that these eye-catching pirouettes continue to be useless as explanatory tools.

CANADIAN CARMELITES AND TIBETAN MONKS

On the other hand, neuroscientific incursions into the devoted person's brain and into that of the unbeliever are

generating increasingly more suggestive findings. One of the pioneer studies was conducted with the collaboration of 15 Carmelite nuns belonging to a Canadian community¹⁴ who were asked to try to reproduce the experience of an autobiographic episode of "union with God," while their brain was being scanned using a Functional Magnetic Resonance. All of them had experienced mystic moments, throughout the vital journey, moments they described as the most intense and profound experience of their existence. They formed a group having variable age (between 23 and 64 years), with a time of dedication to the Carmelite vocation ranging from 2 to 37 years. The mystic remembrance session was performed with rigorous controls: the nuns went through different phases in the scanner, including those of rest-habitation with their eyes closed, moments to remember harmonious episodes with a very loved person and those of remembrance of the experience with the merger with God. They achieved a good recall of these experiences, up to the point of reliving sensations of timelessness and spatial disconnection together with incomparable fullness and pleasure which, in two cases, culminated with the *"divine presence"* during the scanning. The results obtained from comparing cerebral activations and deactivations regarding control conditions (rest and amicable empathy) denoted a "mystical" pattern that recruited several brain systems. Regions of the orbitofrontal cortex, caudates and upper and lower parietal areas, in both hemispheres, were preferentially activated. All this agrees with the complex experiences in which some peculiar corporeal and spatial perceptions are combined with pleasure and serene and intense well-being, in circumstances of disconnection regarding external stimuli and with little reflexive elaboration. The brain activation pattern, definitively, brings to mind those registered in women in love when they look at a photograph images of their loved one in the peak of infatuation.¹⁵

It is not trivial that these results have appeared, up to some degree concordant, between the exceptional experience of the "divine union" and the much more worldly and frequent one, although not necessarily less powerful, of the "loving fusion." In addition to confirming old suspicions on the erotogenic component of the mystical exaltation, these data indicate that we are seeing phenomena comparable to other human experiential reactions that may be object of an empirical approach. Using cerebral mapping methods by the registry of electroencephalographic (EEG) activity, the electrical changes that are self-induced in Buddhist monks with a dilated experience in the meditation techniques have been studied.¹⁶ In a study conducted in Nepal by a North American neurophysiologist team, that had the approval and counseling of the Dalai Lama, the monks that entered into deep meditation recreating a state of unconditional love/compassion for the creatures of this world enormously increased the EEG gamma frequencies (between 25-42Hz) of great amplitude, in comparison with university students with much more limited training in these meditation techniques. This spectacular increase of the EEG gamma frequency band (which in other

experiments has been linked with highly focalized consciousness), occurred, above all, in lateral frontoparietal regions, in both hemispheres, and tended to last beyond the meditative session up to the point of presenting differences at rest compared to the controls. Consequently, these are data that indicate that some procedures of modification of the states of consciousness associated to profound empathic experiences and "religious" rapport induce long-lasting changes in the electrical activity of the cerebral cortex. This type of work has had continuity and studies have already been published that suggest that the changes after prolonged training in meditative techniques may give rise to structural changes in some brain regions.^{17, 18}

It remains to be seen if these findings will remain firm, although the exploratory breach is already open and it does not seem to be a bad beginning to detect phenomena related with abnormalities or singularities in the states of consciousness. It may be well to remember that in the principal monotheistic religions, the culminating moment of the revelation was produced under peculiar consciousness circumstances. Specifically, in all of them, there was the phenomenon of the "mountainous" revelation. This agrees with many cases of walking travelers who have experienced singular experiences within condition of altitude, hypoxia and exaggeration of the visual perspective, there being clinical repercussions in many cases.¹⁹

"RELIGIOUS" NEUROPATHOLOGY: TEMPORAL AND PARIETAL CURVATURES.

All of this also makes it possible to make a connection with classical neurological observations, based on sporadic, although well-studied clinical cases, which had linked focal epilepsies of the temporal lobe with an accentuated tendency to religiousness together with other temperamental peculiarities as hypergraphia or preference for gallant and asexual modalities of love.²⁰ There are recent studies of clinical case series that confirm this relation together with the proclivity to experience mystic experiences: episodes of very singular self-consciousness whose contents are, frequently, universal love-compassion or perceptions of fusion with the "final essence of the cosmos."²¹ ²² The intimate peace, serenity and pleasant sense of fullness are usual tonalities of mood states during these episodes.

Such "journeys" towards borders of dilution/expansion of the ordinary consciousness is that which has been searched for by those hungry for esoterisms who, at different times, have dared to take very strong substances to alter their thought flow. A good part of these potions so venerated by the archaic Shamens and by their contemporary emulators, alter the serotonergic functionality in the brain while inducing abnormalities in other subtle gears of the chemical neuroregulation. In this sense, the finding of a team from the Institute Karolinska, in Stockholm, is important: when they

studied severe cerebral targets using molecular markings with positron emission tomography, they found that the availability of the 5-HT1A serotonin receptors presented consistent relationships with standardized religiousness scales in males.¹² That is, in ordinary young Swedish persons, the greater their tendency to spirituality and transcendence, the lower was the availability of these receptors in the frontal cortex, hippocampus and raphe nuclei, which generally results in greater serotonergic function. Spirituality and self-transcendence (when we perceive that we are something more than the surroundings of our physical being or that we can separate ourselves from it), can be experienced both by believers and non-believers: one can feel anointed to God or to all nature and feel that one's body is fused with the universe as a whole. Some Italian neurosurgeons have been able to link a specific zone of the parietal cortex of the brain to the grade of religiousness: it is possible that a crucial neuronal crossroad for the experiences of transcendence may be found there.

These investigators from the University of Udine (Italy) studied the evolution of the self-transcendence and spirituality feelings in patients with brain tumors.²³ The work was conducted with a large sample of encephalic neoplasms (neural or meninges) in patients who were classified by the type and location of the brain tumors: patients with tumors in the anterior zone of the brain (frontal and temporal cortexes), or the posterior one (occipital and parietal cortexes). The results were distinctive: patients with parietal cortex tumors presented superior religiousness to the others. That is, a greater proportion of these patients considered themselves to be very deeply spiritual. This effect was accentuated after the removal of the tumor, suggesting that a decrease in the neural volume and work in this brain area causes an increase in religiousness. It can be stressed that it was not found that the religiousness indexes would depend on age, education, gender, cognitive capacities or control of emotions. On the other hand, the increase in religiousness co-variated with the malignancy of the tumor and its growth rhythm in the posterior parietal cortex. The locations that were most significantly linked with the religiousness indexes are shown in Figure 1.

The fact that the posterior parietal cortex is responsible for representing the different parts of the body to be able to perceive our body as a whole, in relation to the contextual environment, is well known. For example, patients with lesions in this zone (due to the presence of tumors or trauma, vascular accidents or other reasons) have problems to coordinate parts of their body in space, or feel that some parts of their body do not belong to them. These findings suggest that this brain area has additional functions. To be able to interpret them, the authors propose that the reduction of the parietal cortex activity may be related to the experiences of dilution of corporal limits or extracorporeal perception that some persons go through in the climax of the spiritual experiences.

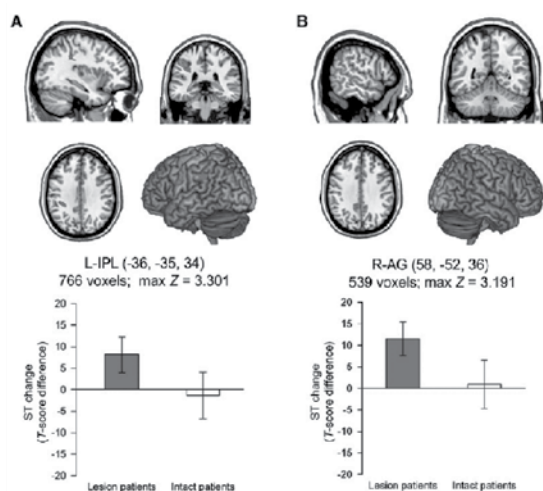


Figure 1

Variations of spirituality based on brain lesion localization. The groupings of voxels that were associated to an increase on the self-transcendence (religiousness) scale are represented on the brain mapping of the Neurological Institute of Montreal. Two groupings, one in lower areas of the left parietal lobe and another in the right angular gyrus, showed more marked differences. The coordinates x,y,z of the center of the group are indicated, together with the maximum value of Z in each group of voxels, as well as the number (N) of voxels where there were significant differences. The differences in self-transcendence (ST), between before and after the lesion, are represented in the two lower figures (after 36)

FROM NEUROIMAGING TO THE GENETICS OF RELIGIOUSNESS

There are concordant data that are not based on the variations induced by radical alterations of the brain tissue, as occurs in cancers. The first normative study on the anatomical variability of defining regions of the brain cortex and its links with religiousness scores was conducted in 40 healthy adult North Americans (20 from each gender) by structural magnetic resonance scans.¹³ The measurements of religiousness made it possible to obtain large vectors that had covariations with zonal volumes from the brain cortex: thus, the "experience of a close relation with God," co-variated positively with volumes of the anterior and middle zones of the temporal lobes; the "fear of divine rage" co-variated negatively with the orbitofrontal and parietal

region volume; and the "pragmatism and religious skepticism" with parietal regions (the right precuneus especially). On the other hand, "religious education during childhood" did not show any relation with cortical volume, which makes it possible to rule out that those links could be due to differences in the religious training and practice received (also taken into account was the possible incidence of factors such as age, educational or economic level and intake of toxic agents that could affect brain volume). This morphological study has been accompanied by many functional studies that measure the changes of regional activity in the cerebral cortex and in other encephalic regions to statements with religious or irreligious content and also distinguish between believers and non-believers.^{24, 25} As a whole, the results have tended to indicate that there are many regions involved in the processing of religious-type beliefs and experiences and that they can be assigned to the "social brain" or of mentalization circuits: that is, the systems in charge of putting the ideation processes per se or those of others in tune (or out of tune). Furthermore, the fact that the parietal regions of the precuneus have been demonstrated to be crucial in the most genuine and personal prayer²⁶ confers them an additional value as crossroad to differentiate between the tendencies to accentuate spirituality or to irreligious pragmatism/empiricism. In another order of things, the findings that have found atrophic changes in the hippocampus, in advanced ages, in individuals who have suffered sudden spiritual reconversions or in the non-believers, manifest that the known antistress action of religion coverage can be followed by brain scans.²⁷

We should therefore conclude that there is more than enough data to involve religious proclivity with singularities of the ordinary and extraordinary brain functioning. Consequently it could be expected that findings in regards to the genetic marking of religiosity will not be long in coming. Studies with well-controlled samples of twins have well established that the religious tendency, in its temperamental components as we have been outlining herein, carry a modest, although not trivial, genetic burden,²⁸⁻³⁰ this being an influence manifested in these estimations of heritability of about 40%. The first genes that have been related with this temperamental proclivity (and therefore, with a neural organization favoring the states of consciousness illustrated above) have not offered sufficiently firm replications.³¹ However, there are other highly promising ones that are related with some of the previously mentioned links of neurochemical regulation.³² Nonetheless, it must be acknowledged that the subject is complex and that it is not at all urgent. There are many other targets that merit an indisputable priority in biomedical research. Therefore, it seems sensible to adopt a waiting attitude for confirmatory results that may take time to arrive, although surprises that have occurred in other fields during undirected incursions (genetics of human linguistic skills, for example) should not be ruled out.

GOD IN THE HANDS OF BIOLOGY?

Advances in brain imaging techniques have favored the notable volatility between investigators who study how the brain processes spirituality. In fact, a campaign of empirical investigations dedicated to the "neuroscience of religiosity" is fully ongoing. It aims to elucidate the mechanisms of spirituality and mystical tendencies from a neurobiological point of view. It is assumed that this type of experience is mediated by the brain, without aiming to discredit the value of the religious beliefs for the devout. Even more, many of the investigators who work in this area do not consider that revealing the neural substrate of spirituality involves undermining the relevance of the notion of God or other sacred concepts or icons. It would be naïve to do it when it has even been possible to demonstrate that intense religious beliefs may involve advantages in the delicate attentional processing and the automatic erasing of errors by the brain.^{33, 34} Therefore, it seems that the ambitious campaigns of Dawkins, Dennet and their allies are also not headed on the way to harvesting greater successes.

In the beginning, we stated that this duet began daring initiatives to tackle the greening of theistic proselytism in some educational setting in the USA and in the Anglo-Saxon cultural world, in general. Many other activists joined this because it is in this area where the strongest apprehensions crackle in the face of the progression of the corrosive machinery of biology. It is here, precisely where the alarms go off and arouse the most fierce antiscientific resistances. The slogan to open hostilities and unite effectives is simple and effective: *give to biology that which is incumbent to it and reserve to God that which is of God. Or, this is, do not let biology penetrate into the folds of the spirit*. In other words, formulated in an expedited way, the heart of the doctrinal disputes of our era. In Spain and in the Hispanic world in general, there is, however, no hurry to enter into these problems insofar as there is no shortage of debates on the question of divine intervention in the future of the cosmos and in the diversification of the forms of nature, including the human brain and their beliefs. Apparently, in our cultural panorama, there are no active creationists nor more or less combative theists, who aim to undermine the teachings of biology in secondary education or in the University. According to the most authorized voices, our societies are a model of accommodation to the tendencies of progress in all settings, from the transgressor social changes to the enthusiastic absorption of scientific knowledge and therefore it is not necessary to debate anything.

Among us, practically everyone affirms to be they are a determined and undeniable evolutionist. Without doubts or conditions of any type. At the same time and in identical percentages (everybody more or less illustrated) proclaims strong and indubitable "antibiologist" or "antireductionist" position. That is, Darwin is accepted, but not the derivations of his ideas.³⁵⁻³⁷ However, I fear that these postures reflect the usual desert now disguised with the appearance of

pseudocoscopolitism of some societies that have been suddenly enriched, thus allowing them the possibility of traveling (in low cost airlines and without being aware of anything) throughout the world. There are many signs of it. I even dare to postulate that the categorical contradiction is not such: in our places, almost everyone continues to be stonily theist (with many and renovated invocations, that is) and they find no problem in placing the tag of divine ahead of the evolutive processes. In other words, biology, as everything in this valley of tears, continues in the hands of God and should thus continue for the solace of old and new inquisitors. Thus, we are where we used to be in spite of the incessant progress in the discerning of the neural devices of religiosity and the unbelieving skepticisms.^{8, 31, 38}

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