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Consciousness, Culture, and the Brain[1]

Abstract:
Human consciousness is a phenomenon that occurs not only in the brain but also in an external network, a symbolic system. This symbolic system is defined as an exocerebrum. The exocerebrum is a system of artificial cultural prostheses that substitute functions the brain cannot carry out through exclusively biological means. The exocerebrum is a symbolic system that substitutes the cerebral circuits that are incapable by themselves of completing functions that are characteristic of human mental behavior. The brain is not capable of processing symbols without the help of an external system essentially made up of speech, symbols, the non-discursive forms of communication (such as music, dance, and painting), and the exterior artificial memories (from writing to the Internet). We are in the presence of a continual spectrum, one in which there is no need to draw a dividing line between the brain and the exocerebrum, between the neuronal circuits and the cultural prostheses.

Keywords:
exocerebrum, brain, consciousness, symbolic prostheses, philosophy of mind

1. Hypothesis

It has long been known that man in his natural state existed only in the imagination of philosophers and naturalists influenced by the Enlightenment. And it can also be suspected that the naked neuronal man does not exist either: a human brain in a natural state is fiction. It is understandable and very positive that from the

1) In the present form the article is published for the first time. An expanded version of the ideas presented here can be found in my book *Anthropology of the Brain: Consciousness, Culture, and Free Will* (Cambridge: Cambridge University Press, 2014).

start, the neuroscientific approach to consciousness was marked by a strong rejection of Cartesian dualism. Gerald Edelman, one of today's most intelligent neuroscientists, opens his book on the subject of the mind with a critique of Descartes' idea of a thinking substance (*res cogitans*) separated from the body.[2] But the matter became blurred when the rejection of metaphysical thinking substances was converted into a blind disregard for cultural and social processes that most certainly are extracorporeal.

The decade of the brain made great strides in explaining some aspects of neuronal functioning, but left the problem of consciousness in the dark. This makes us realize that neurobiology had ignored fundamental aspects without which it would be difficult to advance the understanding of that aspect of the mind. I had spent a good part of the decade of the brain studying, as an anthropologist, the medical sciences that had tried to understand the functioning of the human brain during the Renaissance and the dawn of modernity.[3] I was so absorbed in this work that at times I felt as if I were a practicing physician in Salamanca or Paris in the seventeenth century. The doctors of that epoch firmly believed in the Hippocratic and Galenic humoral theories and therefore easily passed from the corporeal microcosmos to the astronomical macrocosmos. With this background I approached modern-day neurobiology: What would an anthropologist who had returned from a long journey through the Spanish Golden Age be able to understand?

My first impression was the following: neurobiologists are desperately looking in the functional structure of the human brain for something – consciousness – that may possibly be found elsewhere.[4] I wish to stress that I use the term consciousness when I refer to the consciousness of the self or the consciousness of being conscious. I imagined how a Renaissance doctor, when on this same search, would think that the feeling of being a unique separate particle could be due to anxiety produced by a defective function of the pneumatic impulses in the cerebral ventricles, consequently making it impossible to comprehend man's place in Creation. Consciousness would not only be situated in the functioning of the brain but also (and perhaps mainly) in the suffering of a dysfunction.

A motor or pneumatic machine (such as the brain driven by *pneuma* in Galenic medical terminology) is said to "suffer" when it takes on a task that demands more strength than it has and as a result, stops. As a mental experiment, let us imagine that this pneumatic motor is a "brain in a natural state" dealing with a problem that is beyond its capacity to resolve. This pneumatic motor is subjected to "suffering".

Now, let us suppose that this pneumatic brain abandons its natural state, it does not turn off or stop, as would happen with a motor limited to using only its "natural" resources. Instead of stopping and remaining stationary in its natural condition this hypothetical neuronal motor creates a mental prosthesis in order to survive despite intense suffering. This prosthesis does not have a somatic makeup but substitutes weakened somatic functions. It must be immediately pointed out that it is necessary to repress the Cartesian impulses of the seventeenth century physician: these extrasomatic prostheses are not thinking substances that are separate from the body nor are they supernatural and metaphysical energies or computer programs that can be separated from the body like the Cheshire Cat's smile. The prosthesis is actually a cultural and social network of extrasomatic mechanisms closely connected to the brain. Of course, this search must try to find certain specific cerebral mechanisms that can be connected to the extracorporeal elements.

2) Gerald M. Edelman, *Bright Air Brilliant Fire. On the Matter of the Mind* (New York: Basic Books, 1992). Two years later, Antonio Damasio popularized the critique in his book *Descartes' Error. Emotion, Reason and the Human Brain* (New York: Putnam, 1994).

3) Roger Bartra, *Melancholy and Culture: Diseases of the Soul in Golden Age Spain Iberian and Latin American Studies Series* (Cardiff: University of Wales Press, 2008).

4) In no way do I support Skinner's old claim that the study of the brain was an erroneous way to search for the causes of conduct within the organism instead of doing so in the outside world. See: Burrhus F. Skinner, *About Behaviorism* (New York: Knopf, 1974).

Let us return to our mental experiment. We must try to explain why a human being (or protohuman), when facing an important challenge – such as a change of habitat – and therefore feeling acute suffering, creates a powerful individual consciousness instead of becoming paralyzed or dying. Such an event would not occur in the case of a motor (or a fly). The origin of this consciousness is a cultural prosthesis (mainly speech and the use of symbols) that, associated with the use of tools, allows survival in a world that has become excessively hostile and difficult. The circuits of anguished emotions created by the difficulty to survive pass through the extrasomatic spaces of the cultural prostheses, but the neuronal circuits that they connect to become aware of the "outerness" or "strangeness" of those symbolic and linguistic channels. It should be underlined that seen from this perspective, consciousness is not the becoming aware of the existence of an exterior world (a habitat) but rather is the fact that a portion of that external environment "functions" as if it were part of the neuronal circuits. To put it differently: incapacity and dysfunction in the cerebral somatic circuit are compensated for by cultural functionalities and capacities. That the neuronal circuit is sensitive to the fact it is incomplete and needs an external supplement is its mystery. This sensitivity is part of consciousness.

Many neuroscientists insist on the division between the interior environment, precursor of the individual ego, and its external surroundings.[5] It is possible that this belief, deeply rooted among neurobiologists, is an obstacle to advancing the understanding of the physiological fundamental principles of human consciousness. Let us consider a different idea: consciousness would arise from the cerebral capacity to recognize the continuation of an internal process in external circuits located in the environment. We need a type of research that does not accept the categorical separation between the internal neuronal space and the external cultural circuits. To that end, in my interpretation, cognitive processes would have to be thought of as if they were a Klein bottle, where the inside is also the outside. But it is very difficult for this kind of research to advance because many neuroscientists tend to be allergic to using discoveries made in the social and cultural sciences. It is as if a part of the digestive and circulatory mechanism were to artificially occur outside of us. We could contemplate our laminated intestines and veins hooked up to a portable prosthetic apparatus driven by programmed cybernetic systems.

This happens in science fiction cyborgs and in experiments carried out on primates that, thanks to an implanted electrode, have been able to mentally control a brain-machine connection to move a robotic arm from a distance.[6] On the other hand, we are accustomed to being surrounded by prostheses that help us memorize, calculate and even codify our emotions. In relation to this, a book appearing at the close of the decade of the brain and written by the philosopher Colin McGinn, uses a very important image that unfortunately was not fully taken advantage of. In his argument for demonstrating that the human brain is incapable of finding a solution to the problem of consciousness, McGinn imagines an organism whose brain, instead of being hidden inside the cranium, is distributed outside its body like a skin. It is an exocerebrum, similar to the exoskeleton of insects and crustaceans.[7] When this organism experiences the color red, its thinking skin, even though exposed to the exterior, is not more easily understood. The "private" character of consciousness, says McGinn, has nothing to do with the fact that our brain is hidden: experiencing the color red is always buried inside a completely inaccessible innerness. McGinn's error lies precisely in believing that consciousness is buried in the interior. If we imagine that the strange creature with a neuronal epidermis is capable of coloring its belly when it thinks about red, and other organisms of the same species can contemplate and identify that, then we are getting closer to

5) Antonio Damasio, *The Feeling of What Happens. Body and Emotion in the Making of Consciousness* (New York: Harcourt Brace, 1999), 135.

6) José M. Carmena et al., "Learning to Control a Brain-Machine Interface for Reaching and Grasping by Primates," *Public Library of Science-Biology* 1, 2 (October 2003): 1–16.

7) Colin McGinn, *The Mysterious Flame. Conscious Minds in a Material World* (New York: Basic Books, 1999), 11.

our reality: the cultural exocerebrum that we possess really does turn red when we express our experiences with inks and paints of that color. The idea of an external brain was originally outlined by Santiago Ramón y Cajal who, when he proved the extraordinary and precise selectivity of the neuronal networks of the retina, considered them to be a simple brain, located outside the cranium.[8]

I want to go back to the image of the exocerebrum so I can allude to systemic extrasomatic circuits. Different brain systems have been spoken of: the reptilian system, the limbic system and the neocortex.[9] I believe a fourth level can be added: the exocerebrum. To explain and complement this idea I would like to draw a parallel here inspired in the biomedical engineering that builds sensory substitution systems for the blind and the deaf.[10] Neuronal plasticity enables the brain to adapt and to build, in areas that are not affected, circuits that substitute those that function with deficiencies. If we transfer this focus to the exocerebrum we can assume that, in certain hominids, important deficiencies or inadequacies of the codification and classification system, arising from an environmental change or from mutations that seriously affect certain senses (smell, hearing), facilitated their substitution by other areas of the brain closely tied to cultural systems of symbolic and linguistic codification (Broca's and Wernicke's areas). The new condition presents a problem: substitutive neuronal activity cannot be understood without the corresponding cultural prosthesis. This prosthesis can be defined as a symbolic substitution system that has its origin in a set of compensatory mechanisms that replace brain functions that have deteriorated or become deficient due to having to face a very different environment, by means of operations that are based on symbols taken from that external surroundings. My hypothesis postulates that certain regions of the human brain genetically acquire a neurophysiological dependency on the symbolic substitution system. This system is obviously transmitted by cultural and social mechanisms. It is as if the brain needed the energy of outside circuits in order to synthesize and break down symbolic and imaginary substances in a particular anabolic and catabolic process.

2. Antisocial personality disorder and autism

I would like to mention three signs of the exocerebrum within the central nervous system. First I will refer to two illnesses where an accentuated atrophy is observed in the relation between the mind of an individual and his or her sociocultural environment. After this, I will reflect on a third sign: the so called mirror neurons.

It has been known for a long time that lesions in the prefrontal region of the brain provoke antisocial and psychopathic behaviors. The celebrated case of Phineas Gage, the worker who had an iron bar go through his head in an accident in New England in 1848 injuring his frontal lobe, was the emblematic beginning of study on the subject: Mr. Gage went from being a kind and reasonable person to becoming unbearably irascible with a permanent blasphemous, obscene, undisciplined and aggressive behavior.[11] Since then much information has been accumulated on the effects of prefrontal injuries. But now I wish to bring to my aid studies on antisocial persons who have not suffered any injury. They are individuals who have been diagnosed by psychiatrists as having antisocial personality disorder: persons characterized by continuous transgressive and violent behavior, constant aggressive irritability and irresponsible indifference to the harm they inflict on others or on

8) Ramón y Cajal in his work "La rétine des vertébrés" considers the retina to be "a true nervous center, a kind of peripheral brain segment," 121.

9) I am referring to the ideas of Paul D. McLean, *A Triune Concept of Brain and Behaviour (*Toronto: University of Toronto Press, 1969). He refers to three types of brain: reptilian, paleomammallian and neomammallian.

10) Paul Bach-y-Rita. *Brain Mechanisms in Sensory Substitution* (New York: Academic Press, 1972).

11) See a summary of the case in Antonio Damasio's book, *Descartes' error*, chapter 1.

themselves.[12] We can assume that these disorders involve communication defects between internal neuronal circuits that have atrophied and circuits of the exocerebrum. This interpretation is confirmed by research results: persons with antisocial personality disorder, according to images revealed by structural magnetic resonance, showed a significant reduction of prefrontal gray matter (but not white matter). Very importantly, two other groups were also analyzed in this research: drug addicts and schizophrenics or persons suffering from affective disorders. There was no reduction of gray matter observed in these groups who are also persons afflicted with pathologies causing serious social problems.

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Autism is the mental imbalance that affects the connection of the brain with the sociocultural circuits in the most spectacular and disturbing way. It is interesting to recall that the classic text on autism published by Leo Kanner in 1943 describes these patients as "pre-hominid asocial animals", incapable of accepting or understanding changes in routine or in their environment, with no notion of the difference between "I" and "you", that develop good relations with objects and bad relations with people and that have serious linguistic inabilities.[13] That is to say, in my interpretation, they lack an exocerebrum. The cognitive ability of approximately 75 percent of autistics is significantly below average. Evidence seems to prove that autism has a biological origin with important genetic components.[14] It is important to mention that the disabilities of autistics do not arise from intellectual disability, given that a fourth of autistics do not have this condition. Beyond a low level of intellectual capacity, there is a nucleus of problems affecting all autistics: they lack the capacities to establish social relations, they have difficulty with verbal and non-verbal communication and it is very difficult or impossible for them to imagine mental states or intentions of other people. Oliver Sacks has described the autistic condition of an intelligent professor at Colorado State University, Temple Grandin, with his characteristic depth and tenderness. She herself described her situation to Sacks: "A great part of the time I feel like an anthropologist on Mars."[15] She was referring to the lack of emotional empathy, her distance from the experience of others and her difficulty in understanding behaviors and circumstances.

There is a strange and disturbing phenomenon accompanying autism: approximately 10 percent of autistics, who years ago were called "idiot savants", develop a kind of visual and acoustic memory hypertrophy such as extraordinary capacities for copying, reciting or reproducing images, musical plays and texts with great precision but without understanding what they are doing. It seems like a kind of compensation for the dysfunctions of the left side of the brain where the functions tied to logical sequences and linguistic symbolism are based. The result is that these autistic savants have almost incredible abilities in music, art, mathematics, calculus and mechanics but have serious inabilities in speech and language.[16] Research suggests that some kind of damage in the left hemisphere causes an abnormal activation of the right side, like a hypertrophy of the circuits tied to the primitive forms of memory, that lack semantic or cognitive content.

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12) Adrian Raine, Todd Lencz, Susan Bihrle, Lori LaCasse and Patrick Colletti, "Reduced Prefrontal Gray Matter and Reduced Autonomic Activity in Antisocial Personality Disorder," in *Foundations of Social Neuroscience*, eds. John T. Cacioppo et al. (Cambridge, Mass.: MIT Press, 2002), 1023–36.

13) Leo Kanner, "Autistic Disturbances of Affective Contact," *Nervous Child* 2 (1943): 217–250.

14) Simon Baron-Cohen, "The Cognitive Neuroscience of Autism: Evolutionary Approaches," in *The New Cognitive Neurosciences,* ed. Michael S. Gazzaniga (Cambridge MA: MIT Press, 1999), 1249–58.

15) Oliver Sacks, "An Anthropologist on Mars," in *An Anthropologist on Mars: Seven Paradoxical Tales* (New York: Knopf, 1995).

16) Darold A. Treffert and Gregory I. Wallace, "Island of Genius," *Scientific American*, June 2002. Also see Treffert's book, *Extraordinary People: Understanding Savant Syndrome* (iUniverse.com, Inc., 2000).

The connection with the symbolic substitution system is damaged or does not exist in the autistic, so that in certain cases – upon not being able to use cultural circuits – an expansion of the mechanical memory is produced. In this type of living australopithecine the neuronal circuits corresponding to language would be closed and complete and therefore would not look for connections with external prostheses.

3. Mirror neurons

Not only have some neurologists wanted to reveal the mystery of consciousness, but they have also attempted to discover the secrets of genius. The idea that the answer to the enigmas of consciousness must be locked inside the heads of history's most brilliant personalities has translated into an extreme curiosity on the part of certain scientists (and not a few charlatans) to carry out studies directly on the brains of geniuses. Slices of Albert Einstein's brain were given out to various scientists by the pathologist who performed his autopsy. This man kept the thinking organ of the great physicist in a jar for forty years. Close to the end of his life he decided to turn over what was left of it to the genius' granddaughter and so he traveled across the United States by car with the mortal remains. The neurologist Marian Diamond, of the University of California, examined some slices and could only determine that there was a large concentration of glial cells in the area of association (area 39 of the left hemisphere) of Einstein's brain that was greater than in other sections.[17] Apart from that, neither she nor any of the others could find the secret of genius. Of course there had been previous cases of great thinkers whose brains ended up in scientists' laboratories, such as the mathematicians Carl Friedrich Gauss and Sonja Kovaleski. Another famous brain that was the subject of detailed study was that of Lenin. Oskar Vogt, an important German neurologist, was hired by the Soviet government to discover the unique and extraordinary nature of the brain of the great leader of the October Revolution. Vogt, in his laboratory in Berlin, had developed refined techniques for cutting the brain into seriated sections for their study. This physician was looking for relations between mental processes and what he called the "architectonics" of the brain. For two and a half years (between 1925 and 1927) in his Moscow laboratory, Vogt dedicated himself to slicing Lenin's entire brain into tens of thousands of sections that were meticulously mounted and stained for their study. He observed that the third layer of pyramidal neurons of the Leninist cortex were especially numerous and large. Vogt felt certain that the great revolutionary had been born with these large nerve cells and that their size was not a compensation (as perhaps we could suspect) caused by the consequent brain damage of a disease.[18] It appears that the scientists of that time who were familiar with Vogt's report, published in 1929, were somewhat perplexed.

Of course, neuroscientists would prefer to put their instruments into a live human brain if they were able to do so without producing damage. But such an intrusion is possible only on those few occasions when a surgical operation is indispensible. Thus, neurologists who have perhaps dreamt of directly scrutinizing the brain tissue of geniuses have had to be content with opening the heads of far less intelligent beings. But what they have found there is much more interesting and revealing than what was found in the dead brains of Einstein and Lenin. One of the most important events that took place during the so-called decade of the brain was the discovery of mirror neurons in the frontal lobes of monkeys by Giacomo Rizzolatti and his collaborators in

17) M.C. Diamond, et al., "On the Brain of a Scientist: Albert Einstein," *Experimental Neuro*logy 88 (1985): 198–204. See also Michael Paterniti, *Driving Mr. Albert: A Trip Across America with Einstein's Brain* (New York: Dial Press, 2000).

18) Marina Bentivoglio, "Cortical Structure and Mental Skills: Oskar Vogt and the Legacy of Lenin's Brain," *Brain Research Bulletin* 47 (1998): 291–96.

1996.[19] This discovery opens up new scientific perspectives for understanding human brain evolution, language emergence and the mechanisms of consciousness. The finding is apparently very simple: mirror neurons are visual and motor cells, originally detected in the premotor ventral cortex of monkeys (area F5), that have the particular characteristic of being activated when the animal performs an action (such as grabbing an object) as well as when it watches another individual (including humans) perform a similar action. The mirror neuron system is possibly the neuronal basis of social forms of recognition and of understanding the actions of other individuals. It should be emphasized that area F5 of the monkey is homologous to Broca's area in humans. Monkeys recognize actions performed by others because the neuronal activation pattern that is produced in the prefrontal areas is similar to the pattern that is internally generated to produce these same actions. This implicates the existence of a kind of "semantics" inscribed in the motor neurons which are capable of "representing" an action. As can be seen, it is a specular circuit that recognizes acts in the social environment through neurons whose motor action is inhibited so that the action the individual is contemplating is not set off. But they are the same neurons that, if necessary, set the body in motion to perform an observed action (such as pull, push or grab objects). It is also necessary to add that these mirror neurons are not activated (or if they are it is minimal) if the action of the hand only imitates the movement of taking an object when there is no object there. Neither are they activated if the object is pushed with an instrument and not with the hand.

There are solid indications that a system of mirror neurons also functions in the left hemisphere of the human brain. The hypothesis that has emerged postulates that the mirror neuron system observed in monkeys, where motor functions not only control action but also represent it, may be the origin of a human representation system specialized in processing social information.[20] That is to say, a rigid and encapsulated system capable of efficiently controlling the organism's relation with its environment would have been transformed into a flexible and open system capable of managing symbolic information proceeding from a rich and ever-changing multicultural environment.

If we consider my hypothesis of the exocerebrum, we can propose an explanation. We would have to begin from a supposition: an inhibition and difficulty in copying the movement of others would be a condition added to the series of growing obstacles for recognizing the environment. It is true that the human mirror neuron system functions differently from that of monkeys. In monkeys the system is not the basis of understanding or of speech or even of intentional imitation. In contrast, in humans the system is not encapsulated. Not only is it a localized brain circuit but it is also part of the flexible structure that enables speech.[21] At a certain moment, a significant change in the neuronal system of the first humans must have occurred that caused a large increase of mirror neurons, opened the system and connected it to areas of the brain related to vocal articulation and signal processing. As a metaphoric image, let us suppose there is a human being that discovers a new potential: upon witnessing the act of another individual, it can pronounce syllables associated with the movement it sees. Here we would have an example of a typical sensory substitution system. The inherent difficulties of the encapsulated mirror neuron system would be overcome by means of a circuit that would substitute sensory informa-

19) Giacomo Rizzolatti, L. Fadiga and V. Gallese, "Premotor Cortex and the Recognition of the Motor Actions," *Cognitive Brain Research* 3 (1996): 131–41.

20) The social function of mirror neurons appears to be confirmed in a study carried out by Ramachandran and his colleagues. They observed that in humans there is a suppression of electroencephalographic mu waves when normal individuals move one of their hands or watches someone else move it. But in autistics mu wave block occurs when they voluntarily move one of their hands but not when someone else moves it. This seems to indicate that autistics suffer abnormalities in their mirror neuron system. V.S. Ramachandran, *A Brief Tour of Human Consciousness* (New York: Pi Press, 2004), 119, n. 6.

21) Maxim I. Stamenov, "Some Features that Make Mirror Neurons and Human Language Faculty Unique," in *Mirror Neurons and the Evolution of Brain and Language*, eds. Maxim I. Stamenov and Vittorio Gallese (Amsterdam: John Benjamins, 2002).

tion input with the capacity to accept and process symbolic information. Specialists who look for mechanisms for helping the blind assert that, until now, the most successful sensory substitution system is that of Braille. They suggest that reading written signs may be thought of as the first sensory substitution system.[22] To my way of thinking, and using the same logic, the first sensory substitution system in reality was speech, even though in this case – unlike writing – there would be a genetically conditioned neuronal substrate. Syllabic sounds that represent acts and objects artificially substitute the sensory functions of recognition and interpretation that do not efficiently operate except within certain limits. If the action or object is not visible or has a new appearance that disguises it, the sensory system is incapable of interpreting the situation. But the articulated voice of another individual can symbolically signal the existence of the act or object that for some reason the senses cannot recognize (it has been destroyed or hidden, for example). As Rizzolatti has pointed out, the basis of this new capacity is the fact that, before the emergence of language, the precursor of Broca's area was endowed with a mechanism for recognizing actions carried out by others.

These discoveries question the Chomskian theory of a universal grammar emanating from a single mental organ that mysteriously appeared at some point in time during the evolutionary process. The basis of speech is not a specific module but rather it would have evolved from different neuronal structures that originally had no relation to communication mechanisms. A formalistic interpretation of language that greatly emphasizes syntactic structures to the detriment of semantic, metaphoric and symbolic functions lends support to the idea that there is a genetically determined neuronal device for speech. It has its roots in the postulate that there is an inscribed universal grammar in the brain that upon connecting with the social environment, triggers and generates the development of different languages in children, all constructed from the same syntactic model. Many neuroscientists find this idea as sterile as the old Cartesian interpretation.[23]

4. Art

Human symbolic expressions are not limited to language and speech. The plastic abilities that enable drawing, painting, modeling and engraving have generated a wide variety of symbols. The same is true for music and dance. In these non-discursive forms of expression we find a relation between significant signals and symbols but we do not find, as in language, the minimum units of meaning (words) that can be combined in sequences that have their equivalent in different languages. Colors, images, body movements or tones are not part of vocabulary and the structures that join them are not syntax. And nevertheless these expressions form symbolic flows or conglomerates that evoke feelings, ideas and emotions by non-representative means. If we wish to understand symbolic expressions as components of the exocerebrum we must not think only of their complex and sophisticated forms that are characteristics of advanced civilizations. We do not need to analyze the art of, let us say, Dimitri Shostakovich, Isadora Duncan and Pablo Picasso as part of the exocerebrum. However, we must accept the fact that at least part, perhaps a small part, of modern symbolic expressions (both discursive and non-discursive) is closely linked to neuronal networks that rely on the existence of external connections. This small part of the exocerebral symbolism is that which we can suppose was already present when the first humans began to make statuettes, paint cave walls and probably to sing, dance and speak. How does a neuroscientist approach the world of art? Dr. Ramachandran dedicates an entertaining chapter of his book on consciousness to art and I am interested in citing it because an important part of his

22) Paul Bach-y-Rita and Stephen W. Kercel, "Sensory Substitution and the Human-machine Interface," *Trends in Cognitive Sciences* 7 (2003): 541–46.

23) Edelman, *Bright Air, Brilliant Fire*, 241.

reflection is inspired by animal behavior when confronted by a prosthesis. He takes the example from Nikolaas Tinbergen who carried out some experiments on herring gull chicks. Just barely out of their shells they begin to peck at the red spot on their mother's yellow beak; she then regurgitates semi-digested food to feed her young. The chick obviously reacts in this way due to the fact that certain nervous circuits in the visual zone of its brain are specialized in recognizing gull beaks. In the course of his experiments, Tinbergen presented an artificial beak with a red spot to the chicks and they reacted in exactly the same manner even when the scientist's hand, instead of their mother, was behind the beak. But Tinbergen took things to the extreme: he took a large yellow stick with three red stripes and showed it to the chicks. They reacted with even greater enthusiasm in front of this curious artifact that did not even look like a gull beak: they preferred the prosthesis to the real beak. And this is where Ramachandran's idea comes in: "If herring-gulls had an art gallery, they would hang a large stick with three red stripes on the wall; they would worship it, pay millions of dollars for it, they would call it a Picasso, but would not understand why they are mesmerized by this thing even though it doesn't resemble anything."[24] An ethnologist studying Ramachandran's speculations could ask himself: why does this neurologist think that art lovers who buy contemporary art act just like gull chicks? Because he is convinced that there is a perceptual grammar that contains universal primitive figural elements, one of which is the attraction for representations in which certain significant features have been hyper-emphasized to the point of being completely deformed (like the yellow stick with three red stripes). The extended attraction among many neurologists to the idea of mental modules that function as archetypes and that interest them more than the prostheses and artifacts that they eventually rely on, is very symptomatic. This attraction is justified by the evidence that there are a good number of symbolic operations that have their basis in neuronal circuits. Ramachandran considers there to be various signs that "sensory metaphors" are inscribed in the nervous system, as demonstrated by synesthetic phenomena that connect areas of the brain that are usually separate.[25] He mentions three tests. First, the links between sounds and images that seem to be deeply rooted in the brain, like the one that is established between the sounds *booba* and *kiki*. Ninety-eight percent of people (from different cultures) associate these two sounds with a bulbous figure similar to an amoeba and a jagged figure with an uneven and shattered edge, respectively. This and other examples would demonstrate that we are facing the previous existence of a non-arbitrary translation of the visual appearance of an object (represented in the fusiform gyrus) and the representation of a sound (in the auditory cortex). [26] Second, he supposes an association between the visual area and Broca's area (that controls vocalization muscles); for example, a test would be that the small objects are symbolized in different languages with words that make the lips imitate the sound ("diminutive") and big things that force the mouth to open ("enormous", "large"). To this not very convincing argument he adds a third association between the areas of the hand and the mouth, which are known to be adjacent in the homunculus motor drawn by Penfield. Darwin had already observed that people frequently move their jaws unconsciously when cutting with scissors.

An essential aspect needs to be considered in these examples, including the case of the chick that accepts a stick as a metaphor of the maternal gull bringing it food: the presence of an external symbolic artificial element, a prosthesis that appears in the form of a drawing, a word, an instrument or a simulation (of a beak). I have no doubt that the use of these prostheses relies on processes of synesthesia in the brain. This internal synesthetic process operates through electrical and chemical signals that travel among regions (motor regions of speech, visual centers and the fusiform gyrus). But in my opinion it is very difficult to suppose that correspondence

24) Ramachandran, *A Brief Tour of Human Consciousness*, 47.

25) Ibid., 62.

26) Ibid., 77.

relationships among regions utilize symbolic and metaphoric codes. The internal flow of signals needs to be able to establish synesthetic connections with external symbolic prostheses, as opposed to doing so only among different areas of the brain.

Let us go back to the mental experiment of gulls interested in art. For them to have gotten to the point of forming a society willing to organize exhibits, they had to fabricate symbolic prostheses themselves that enable them to have a stable cawing system for communicating with each other, in addition to many other devices and social institutions. Perhaps a mutant group of gulls understood the importance of Tinbergen's simulation and was gradually able to develop into an advanced civilization from that divine breath of sorts. But the first evolutionary steps of a hypothetical group of intelligent social gulls would have to be the development of a minimal package of exocerebral prostheses to be able to survive in a dangerous environment. To this end the cultured gulls (just like primitive humans) would have to have some kind of system enabling them to link and establish connections between internal signals and external symbols. Gull or human self-awareness would appear when this step from inner signals to external symbols that are understood by other individuals was produced.

When Ramachandran approaches this problem he proposes an idea that, had he examined it thoroughly, would have led him directly to the exocerebrum. He suggests that unconscious sensory representations acquire the condition of *qualia* during the process of being encoded into manageable sets that can reach the central executive structures of the brain. This produces other high-level representations that he calls "meta-representations" and that can be considered "almost as a second 'parasitic' brain" that allows for more economical descriptions of the automatic processes that the first brain carries out. [27] There are two alternatives here: to propose a kind of internal and private homunculus or to go a step further and imagine that this second brain is external. Ramachandran accepts the first option and believes that the cerebral homunculus is responsible for carrying out representations of representations (that is: metarepresentations) and because of that, is tied to linguistic abilities. It seems necessary for consciousness to come into being in a type of jump from one kind of representation to another. But some neurologists, like Ramachandran, are afraid that the jump will catapult them into external space, outside of the nervous circuits. They prefer to remain inside the brain even when that means having to embrace the Cartesian homunculus in its metarepresentational incarnation as a translating and mediating structure.[28]

5. Conclusions

Very many people, especially if they have religious inclinations, resist the belief that their affections and feelings are merely a property of the nervous system. They have difficulty accepting that consciousness is a biological peculiarity of the brain, the same way that digestion is a biological characteristic of the digestive tract, to use the expression of the philosopher John Searle.[29] It is difficult for even non-religious persons to accept that consciousness is the whole of organic processes belonging to a perishable encephalic mass. Of course, one of the main quandaries lies in the fact that the affirmation that consciousness does not exist outside of the brain is equivalent to accepting that there is nothing after death.

27) Ibid., 99.

28) Ramachandran admits that even though the ego is private it is greatly enriched through social interaction and he accepts the fact that it is possible for it to have evolved principally in a social environment. Furthermore, he believes our brains are inextricably tied to the cultural atmosphere. But society and culture are vaguely defined as "environment" or "atmosphere" without recognizing that there are structures and circuits in this habitat that can form part of that «parasitic» brain. (Ibid., 105, 108).

29) John R. Searle, *Mind: a Brief Introduction* (Oxford: Oxford University Press, 2004), 115–116.

It should be recognized that people are right when they intuit that biological processes alone do not explain consciousness. However, looking to the religious belief in an immortal soul as an explanation of consciousness does not solve the problem, but rather it escapes from it. Perhaps it placates the melancholy that is born from the thought that identity that is lived in the present lacks a future once life is lost. But the intuition that there must be processes or dimensions outside of the brain that help explain the phenomenon of consciousness should not be discarded as a metaphysical vision lacking scientific rigor. I have searched for exocerebral means in the cultural and social world that help to understand the problem of consciousness. Now I would like to refer to a proposal that, without being religious, defends the idea that there is an immaterial world of mental states, conscious and unconscious, that Plato would have defined as "affects of the soul", between the physical and sociocultural world. This is the interpretation defended by the philosopher Karl Popper and the neurobiologist John Eccles in a book that was very much discussed some years ago and that still arouses interest (*The self and its brain*).[30] In this book Popper defends a triadic more than a dualist idea, since he insists in defining an intermediate world between physical states of the brain (World 1) and the sphere of language and social or cultural products of thought (World 3). This intermediate world is that of consciousness of the self and of death, with its base in the sensitivity that is characteristic of animal consciousness (World 2). Unlike his friend Eccles, Popper does not believe that the second subjective world survives beyond the death of the individual. Very few scientists today agree with the ideas of Eccles and Popper since it certainly does not seem necessary or useful to insist on the old Cartesian ideas that separate the subjective world from its organic bases. Popper forcibly introduces the second world of sensibility and consciousness as a kind of mortal soul but does not succeed in showing that actually it is nothing more than a configuration of the cultural world based on the brain. However, it is interesting to observe that Popper recognizes that our personalities and identities "are anchored in all the three worlds, and especially in World 3." And he adds: "I suggest that a consciousness of self begins to develop through the medium of other persons: just as we learn to see ourselves in a mirror, so the child becomes conscious of himself by sensing his reflection in the mirror of other people's consciousness of himself."[31]

The hypotheses of Eccles and Popper, rejected today by the majority of scientists, contributed to paralyzing the interest in the connections and interactions of the brain with its surroundings since it was feared that this could open the door to dualism. By opposing (and rightly so) the idea of the second world (the soul), neurobiologists also refused to study the functions of what Popper called World 3, the world that contains the exocerebrum that I have been reflecting upon. Even Eccles forgot about this dimension in order to hang on to a dualism through which he stubbornly tried to demonstrate the existence of a subjective mental world defined by "psychons" that supposedly modify brain activity in a way that is analogous to the probability fields of quantum mechanics.[32]

I have cited the ideas of Popper and Eccles because, in an almost graphic way, they are an example of the obstacles confronting the search for the exocerebral connections of consciousness. If every time we investigate the cultural environment of the brain, the specter of an intervening dimension of a more or less metaphysical nature appears, perhaps we would have to prohibit any search of this kind, unless we were to accept the inevitability of such a spiritual dimension, despite recognizing the impossibility of understanding it from

30) Karl R. Popper and John C. Eccles, *The Self and its Brain* (Berlin: Springer-Verlag, 1977).

31) Ibid., 108, 110.

32) John C. Eccles, *How the Self Controls its Brain* (Berlin: Springer-Verlag, 1994), 81–88. Eccles supposes the existence of a group of elemental mental events that he calls "psychons" that are linked to fixed anatomical structures; he wants to calculate the influence of psychons with the Heisenberg uncertainty principle. All this seems to be a not very interesting attempt to scientifically prove the existence of the soul.

a scientific perspective. In reality, the postulate that there is a particular subjective mental dimension separate from biological and cultural realities is a wall that blocks research and makes us blind. It is as if, let us suppose, before the eyes of a reader of *Madame Bovary*, a thick swarm of spirits, psyches, psychons, translators, interpreters, epiphenomena or souls would emerge, establishing themselves as the incarnation of an ego that – with the help of the brain – would be perceiving the erotic melancholy of Emma, the great personality created by Flaubert. I believe that there is actually nothing between the reader's brain and the pages of the novel. Consciousness is simultaneously found in the brain and in the book – not in a metaphysical dimension. The same thing happens when that reader of Flaubert decides to listen to Prokofiev, contemplate an engraving by Klimt or converse with a friend: there is no mediating substance between the individual and what he listens to or contemplates. The existence of neurocultural networks does not demand the belief that there is a spiritual space different from nervous textures and social structures. The exocerebrum is not something that is located between the neurons and culture, but rather it is a structured environmental segment that continues certain brain functions by other means.

However, neurological science, with a strong positivist charge, locked the subject of consciousness in the jail of the cranium and insisted on deciphering the operations of a solitary ego – essential and universal – incapable of overstepping the boundaries of factual discourse, like Wittgenstein in his *Tractatus*, that prohibits any and all escapade toward the empty spaces of silence that supposedly surround the dominions of language. I have wanted to cite Wittgenstein to show with his example the dead-end of an empiricism that stubbornly imposed limits to exploration. Wittgenstein himself became aware of the problem and in his later studies made a spectacular change of direction by opening the windows of the transcendental ego to the huge phenomenological window of cultural experiences. I share the sharp critical dissection that Ernest Gellner has made of Wittgenstein's turnabout, but this is not the place to enter into that spiny subject.[33] I only wish to point out that possibly due to the fact that Wittgenstein realized his errors in the *Tractatus*, he had the intuition that it seems to me pertinent to cite here: "One of the most dangerous of ideas for a philosopher is, oddly enough, that we think with our head or in our heads. The idea of thinking as a process in the head, in a completely closed space, gives him something occult."[34] Wittgenstein refuses to abandon the idea of the insuperability of the abyss between consciousness and brain processes,[35] and in fact explores the possibility that there may not be a psychophysical parallelism, that there is a causality without physiological mediations and that it does not mean believing in a vague entity.[36] Giving up the search for psychism's neurophysiological correspondences is absurd and, nevertheless, from these concerns, it occurs to him to suppose that the specifically organic mental process can be "substituted" by an inorganic process that provides a prosthesis for thinking. Wittgenstein asks himself: "How should we have to imagine a prosthetic organ of thought?"[37] It seems to me that I have in some manner answered his question, although in a way that he certainly would not have liked.

33) Ernest Gellner, *Language and Solitude. Wittgenstein, Malinowski and the Habsburg Dilemma* (Cambridge: Cambridge University Press, 1998).

34) Ludwig Wittgenstein, *Zettel*, ed. by G.E.M. Anscombe and G.H. von Wright (Mexico: Universidad Nacional Autónoma de México, 1979), § 605–606.

35) Ludwig Wittgenstein, *Philosophical Investigations / Philosophische Untersuchungen* (Oxford: Blackwell, 1953), § 412.

36) Wittgenstein, *Zettel*, § 611.

37) Ibid., § 607. He asked himself before: "Is thinking a specific organic process of the mind, so to speak -as it were chewing and digesting in the mind"? See Roland Fischer's stimulating essay "Why the mind is not in the head but in society's connectionist network". He sustains the idea that the mind is found in the interaction between society and individual. The proposal is not developed but it points toward the definition of an individual consciousness as a unit of reproduction in cultural evolution in the same sense that genes are reproduction units of phenotypical organisms.

The fact that consciousness is not a hidden phenomenon locked up in the cranium and that we can examine its florid arborescent prostheses in the open spaces of cultural life does not mean that the mysterious halo pervading the subjective sensation that we humans have of being a unique self, irreplaceable and unrepeatable, disappears. I am convinced that science will be able to solve the mystery. Those who declare that if consciousness is a mystery and not a puzzle, then we will never be able to understand it, are wrong. The mysterious – I would say poetic – quality of consciousness does not place it outside the reach of our comprehension. In fact, it was a poet who in his language stated a revealing fact. At the height of an anguished search for his poetic identity Rimbaud uttered a disconcerting phrase: "*Je est un autre*."[38] It was referring to the profound immersion of the poet into the world surrounding him. Paradoxically, it is an affirmation of poetic identity that at the same time dissolves the self into the other.

I is another – a strange expression that challenges us to reflect. In some mysterious way it expresses the idea that I have presented: consciousness of our individual identity extends to and includes the others. The poet reminds us that consciousness is born out of suffering and out of the assimilation of that suffering through the help of others, because we blend with them in order to confirm our transitory identity. In this way we lose the soul but we attain consciousness.

38) He repeats the expression in two letters: one from May 13, 1871 to Georges Izambard and one written two days later on May 15 to Paul Demeny. Arthur Rimbaud, *Oeuvres completes* (Paris: Gallimard, 1972), 249–250.

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