

The nature of language*

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Keynote Speech

ABSTRACT

The present discourse of admission to the Mexican Academy of Language traces the biological foundations of human language in animal behavior, hominization, and neuroscience.

Intentional and symbolic animal expressions constitute evident foundations of human propositional language and thought. Through arduous training, individual parrots and apes learn, recognize, and express abstract symbols, while vervet monkeys in their natural habitat produce different cries to identify their predators. A communicative intention is further suggested by social play, tactic deception, Machiavellian intelligence, or calls to name individuals. Such capacities evolved toward *Homo sapiens* and its early pictorial representations show adaptive and innovative symbolic talents based on neuronal networks that generate cognitive resources in coordination with the environment.

Right-hand skills, tool production, symbolic language, and left hemisphere predominance constitute associated capacities emerging during the human split from the apes 2.5 million years ago. Even though the modularity of language engages specialized brain areas for expression and comprehension, meaning requires a wider connectivity. Processing verbal information involves the activations of neural networks genetically-disposed in a brain device that is conditioned by repetitive learning. Linguistic representation utilizes firing codes of neurons organized in such networks; their contents are determined by the origin and destiny of the neural pathways, while meanings emerge from the dynamic patterned process of the interconnections among brain modules. The human symbolic realm is detectable in the world of expression and culture because it is mediated by social processes joined with brain processes through appropriate practices. Meaning is thereby conceived as a dynamic handle with an external or cultural loop, and an internal or neurosemantic loop.

The nascent contribution of biological, cognitive and cerebral sciences in coordination with humanistic disciplines to understand the nature of language is as revealing as it is challenging.

Key words: Language, communication, neuropsychology, culture.

RESUMEN

El presente texto de ingreso a la Academia Mexicana de la Lengua perfila los fundamentos biológicos del lenguaje y el significado en la conducta animal, la hominización y la neurociencia.

Las expresiones intencionales y simbólicas en animales constituyen claros cimientos del lenguaje y el pensamiento proposicional humano. Mediante entrenamiento, ejemplares de aves y simios aprenden, reconocen y expresan símbolos abstractos, en tanto que los monos verdes en su medio natural emiten diferentes voces para identificar a sus predadores. La intención comunicativa está además sugerida por el juego social, el engaño táctico, la inteligencia maquiavélica o los silbidos para nombrar individuos. Dichas habilidades evolucionaron hasta el *Homo sapiens* cuyas representaciones pictóricas iniciales marcan una simbolización adaptativa basada en circuitos neuronales que generan recursos cognoscitivos en coordinación con el medio.

La destreza derecha, la fabricación de herramientas, el lenguaje simbólico y la predominancia del hemisferio izquierdo son capacidades engarzadas que emergieron durante la escisión humana de los simios. Si bien la modularidad del lenguaje implica zonas especializadas para su expresión y comprensión, el significado requiere de una amplia conectividad. Procesar información verbal requiere la activación de redes genéticamente dispuestas en un dispositivo cerebral que se acondiciona por aprendizaje repetitivo. La representación lingüística utiliza códigos de disparo de neuronas organizadas en dichas redes cuyos contenidos están determinados por el origen y destino de las vías, en tanto que el significado surge de la pauta dinámica de las interconexiones entre los módulos. El ámbito simbólico humano está la vista en el mundo de la expresión y la cultura pues está mediado por procesos sociales acoplados a procesos cerebrales mediante una práctica. El significado tiene así un asa externa o cultural un asa interna o neurosemántica.

La contribución de las ciencias biológicas, cognitivas y cerebrales coordinadas con las humanidades para comprender la naturaleza de la lengua es tan reveladora como desafiante.

Palabras clave: Lenguaje, comunicación, neuropsicología, cultura.

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And I write... what do I write for? Come back
 To the depths of the soul
 Tempestuous imagery!
 Go to dwell with the dead memories:
 So that the trembling hand upon the paper may write only
 Words, words, and more words!
 Where did the pristine and pure form of the idea
 Remain veiled?

Rosalía de Castro
 (Excerpt from the poem ¡Silencio! [Silence!]
 published in *Follas Novas*, 1880)

1. INFORMATION, COMMUNICATION, LANGUAGE

Language is not limited to words, utterances, or arguments; it secures and links together multiple available types of language, thanks to the evolution of living beings, the physiology of the brain, and the perceptive and expressive systems of the body. There is communication and language in gesture and smell; in music and in painting; in maps and in buildings. A biochemical language is attributed to ecosystems, which allows a plant to attract the pollinator that propagates it, or deter the defoliator capable of stripping it. In *The Descent of Man*, Charles Darwin considered that birdsong was the biological analogy closest to human language and he therefore considered it a "protolanguage" that was favored in evolution via the mechanism of sexual selection.¹

Sexual selection would imply that the feature presented itself only in males, but birdsong in females has been demonstrated to exist in many bird species. In spite of this inaccuracy, it is still possible to argue Darwin's notion about the phrasing of birdsong as an indication from which elements of speech and music have been selected, but by other evolutionary mechanisms that have not yet been explained. Based on various analyses of animal communication, researchers from Massachusetts Institute of Technology² argued that birdsong is similar to the expressive aspect of human phrases (which accepts variations), inasmuch as the communication of bees or vocalizations of primates are more similar to the lexical aspect maintained by basic structure (such as subject, verb, and predicate) of human language. They therefore speculated that some 80 thousand years ago, humans fused these two aptitudes to engender language in its current dimension.

Following the theoretical guidance of Darwin in terms of the adaptive value of animal behavior, the Nobel Prize-winning ethologist Konrad Lorenz found foundations of dialog in courting or aggression rituals performed by many species of birds.³

More definitively, elements of speech are manifested in the songs of the humpback whale (*Megaptera novaeangliae*) in which coherent sequences of shared notes allow whole shoals of fish to be hunted in groups using a bubble-net generated in coordination between many individuals.⁴

Cognitive ethology detects even closer beginnings in three distinct alarm cries used by the vervet monkey in the African savanna to alert its troop of the appearance of predators, as we will see shortly. We therefore understand that language is not simply a cultural construct, but rather it is based on the capacity for communication that we share with other animal species. As such, far from separating human beings from nature due the faculty for language, this growing evidence intensely links them together, because it places humans in the center of a profuse natural framework of information and communication.⁵

Just as we recognize this semiotic link with the animals of the world, so too must we realize the differences which occur from the vastness of information existing in the structure of the cosmos, passing through animal communication, and arriving at intentional and symbolic expression of verbal human language. I ask the listener or reader to imagine three concentric circles, one within the other, like an archery target. The largest outside ring is the world of information, the network of forms and signals manifesting from the *spiderweb* that maintains the structure of galaxy superclusters, to the instructions issued by DNA to determine the form and function of every little cell. This is the world of information that permeates the structure of the cosmos like an almost intangible glue.

Now, within this colossal universe of information is the next circle filled with communication, where information moves in the form of signals produced by an issuer and decoded by a receiver. This is a crucial characteristic of life on earth, as living things are exquisitely sensitive to signals

¹ Darwin Ch. (1871). *The descent of man and selection in relation to sex*. London: John Murray. Translated as: *El origen del hombre* by Joan Domenech Ros for Crítica (Barcelona, 2009). For a more current revision of this subject, see: Doupe AJ, Kuhl PK (1999). Birdsong and human speech: Common themes and mechanisms. *Annual Review Neuroscience*, 22:567-631.

² Miyagawa S, Berwick RC, Okanoya K. The emergence of hierarchical structure in human language. *Frontiers Psychology* 2013. DOI: 10.3389/fpsyg.2013.00071.

³ One of the latest works by Lorenz translated into Spanish is *Estoy aquí ¿Dónde estás tú?* [Here Am I; Where Are You?] (Translation by Manuel Vázquez. Barcelona: Plaza & Janes, 1989) in which, in collaboration with Michael Marlys and Angelika Tipler, he comments broadly on his research over more than five decades into the behavior of the greylag goose. The title implies the meaning communicated by the birds' cawing, justified through detailed ethological observations.

⁴ Wiley D, Ware C, Bocconcelli A, Cholewiak D, Friedlaender A, Thompson M, Weinrich M (2011) Underwater components of humpback whale bubble-net feeding behavior. *Behaviour* 148 (5): 575 DOI: 10.1163/000579511X570893.

⁵ For more information on the ethological bases of human language, see: *Del gesto a la palabra* [From gesture to words]: la etología de la comunicación en los seres vivos by Boris Cyrulnik. Translation by Marta Pino Moreno. Barcelona: Gedisa; 2004.

that are significant to them and at discerning them from the "background noise". Detection of stimulants characterizes the sensitivity of living matter and comes not just from activation and response, but from meaning, as its replica in the environment has direction and aim; an indispensable factor of evolution. Life involves communication within every cell; between tissues, organs, and systems; between the organism and its niche; or between individuals via messages that are chemical or physical, and eventually semantic and symbolic. In his book *The Wisdom of the Body*, 1932, the eminent physiologist Walter Cannon⁶ discerned that the functional cooperation of distant tissues through nervous and molecular signals provided the organism with a kind of intelligence reflected in homeostasis.⁷ These functional and densely interwoven swarms in the body are semiotic because they constitute organized networks of signals that can constitute meanings when they are linked with the world in symbolic connections.

Finally, in the center of this circle of communication is the bullseye of spoken language, defined by the symbolic value of signals. Unlike the previous circle, words are signs that allow re-creation, management, and transfer of information in the absence of the nominated object; an evolutionary prose that requires significance, memory, imagination, representation, or intention; cognitive faculties which facilitate the action of thinking and communicating thought. Language is a restricted albeit culminant sector of communication, as it involves signals whose content is no longer directly related to its physical constitution. Linguistic capacity increases by orders of magnitude the information it is possible to process and transmit, as through acts of speech and comprehension, the issuers and receivers of language share representations and knowledge as it happens in the moment. Therefore, as we move from the edge of target towards the bullseye, the layers that separate information from communication and communication from speech are marked by a condensation of messages and also of knowledge and awareness, which in a mirroring game, enable the conception of information, communication, and the imaginary diagram itself that we just brought to mind.

It is appropriate to distinguish basic awareness - the capacity to feel, from the widespread and higher order: the capacity to know. The majority of mobile life forms are capable of feeling; they show excitability, sensitivity, and sense. Sentient beings, encephalized beings, add the faculty of knowing and expressing signaling, cognition, mapping, memory, and representation. It is possible to discern more finely between non-propositional knowledge, when representation is not coded in the form of language, and proposi-

tional knowledge gathered in a symbolic system that finally allows semantic self-awareness: the knowledge of knowing oneself. While considered a system of signals or articulated sounds which allow communication of mental states, speech also involves hearing and the buccopharyngeal cavity, particularly the tongue, the organ and universal metaphor for language. But it so happens that language is more than just speaking and understanding locutions. It is a multiple rhetorical interaction that involves actors, distances, voices, tones, or gestures; acts of speech⁸ which occur in an abundant social context not just of norms of interaction, but of worldviews derived from, and moderated by, language.

However, as established by Ferdinand de Saussure in 1916,⁹ the core of all language is meaning, understood as the mental content given to a signal or signifier. How is the meaning of a word or locution stipulated or understood? Herein lies the core of semantics.

For a long time, meaning was considered to be the association between a concept and a mental image: the word *caballo* [horse] generates in the mind of a Spanish speaker the image of a vertebrate animal with certain characteristics, and that image constitutes the meaning. However, at the end of the 19th century, the mathematician and philosopher Gottlob Frege affirmed that meaning is not a simple and private mental association between an image and a word, as the reference and the sense, which according to the theory forms the meaning, overtake the individual.¹⁰ In the 1930s, the Soviet psychologist Lev Vygotsky considered words the conventional substitute for the action of pointing, in which the signifier would be the index finger and the meaning would be the object indicated.¹¹ More famously, Ludwig Wittgenstein proposed that the meaning of a word is in its use.¹² Hilary Putnam, in an essay from 1975 entitled *The meaning of 'meaning'*,¹³ also took an externalist position in that meaning is not just in the head, but in the world around us. If someone says "there is water in that glass" and the listeners understand the phrase, that indicates that all of them, the speaker and the listeners, at any time and place, have the same notion of what there is in the glass: something external to the language determines the meaning of a word.

⁸ John Searle (2001). *Speech Acts*, Editorial Cátedra.

⁹ In his posthumously-published *General linguistics course*. The Spanish version was published by Payot (1995).

¹⁰ See "On Sense and Reference" in *Estudios sobre semántica*, translated into Spanish by Ulises Moulines. Barcelona; Ediciones Orbis; 1962.

¹¹ In: *Thought and Language*, translated into Spanish by María Margarita Rotger. Ed. La Pléyade, Buenos Aires, 1987.

¹² See *Investigaciones filosóficas*, translated into Spanish by A. García Suárez y C. Ulises Moulines. Institute of Philosophical Research (UNAM) and Crítica, México, 1988.

¹³ "The meaning of 'meaning'", included in *Language, Mind and Knowledge* (Minnesota Studies in the Philosophy of Science, vol. 7, ed. Keith Gunderson, Minneapolis: University of Minnesota Press, 1975, pp. 131-193). Translated into Spanish as *El significado de "significado"* in *Teorema* magazine, vol. XIV/3-4. The ingenious title had appeared decades before in the celebrated 1923 essay *The meaning of meaning* by the linguist Charles Ogden and the literary critic Ivor Armstrong Richards, who proposed the study of meaning as an inter-disciplinary work which originally included semantics and psychology. This book was translated into Spanish as *El significado del significado*, Paidós, Buenos Aires, 1964.

⁶ *Wisdom of the body*, 1932. Translated by Augusto Pi Suñer and published into Spanish by Editorial Séneca in 1941.

⁷ This important concept was coined by Cannon himself and was later applied by cybernetics in systems which reached equilibrium control through flows of retro-information present in ecosystems, the biosphere (Gaia hypothesis), or social structures, among others.

These are essential contributions in the sense that the use of a word and its multiple social links are contextual elements necessary to stipulate the meaning –the external handle of the language– but they do not seem to be enough, as it is necessary for there to be an association of the concept with an acoustic signal: the internal handle of the language. This association is something intrinsic in thought, a faculty that allows the conventional meaning of a linguistic sign to be apprehended, which is called the content of a locution. At the end of the 19th century, Charles Peirce formulated a triangle of semiotic relationships between a reference (object, reality) a signal (word, signifier), and the specific mental process (concept) implied in the language. He therefore highlights the intimate connection between thought and language, because in thinking, we are aware of some feeling, image, concept, or any representation that functions as a signal:¹⁴ how does this wonder occur?

Meanings allow a creature to acquire certain characteristics from an object: color, size, shape, taste, smell, texture, weight. The organization of this information is constituted in a cognitive unit which abstracts the essential characteristics of an object, leading to the formation of a non-propositional concept. But when the concept is associated with a word, a name, it acquires surprising properties. It establishes a causal connection between a community of speakers through abstraction.¹⁵ In a way that is not well understood, the word provides a mental access or *insight* into the nature of what it signals, and what Borges said can therefore be understood when he stated: “in the letters of ‘rose’ is the rose”,¹⁶ or Umberto Eco with his cryptic title *The Name of the Rose*.

Furthermore, the concept involves levels of comprehension that enable other concepts to be settled, categorized, and classified. The meaning does not reside in the term itself, but rather in the network of meanings it establishes with others in the methodical and malleable archive that is semantic memory. The Russian neuropsychologist Alexander Luria considered words to be a network of connections and potential relationships to which an object can be referred.¹⁷ Even more extraordinary is the fact that a verbal act of language, such as speaking a phrase, can be considered true or false according to whether or not it conforms with world facts, which is one of the most prickly subjects in philosophy of language, thoroughly anticipated by John Locke.¹⁸

Until now, when sounding out the nature of language, I have linked ethology with semantics. I now propose advancing by two routes in natural science: the evolution of communication, already outlined with examples from ethology, and the neuroscience of language and meaning.

2. THE EVOLUTION OF KNOWLEDGE

It is worth referring to two individuals from different species who have shown impressive capabilities of semantic categorization and expression, and arithmetic: a grey parrot named Alex (*Psittacus erithacus*) and a bonobo named Kanzi (*Pan paniscus*), *who*,¹⁹ through ingenious or ardent training, have been able to learn and recognize abstract symbols. Alex would respond to verbal questions from Irene Pepperberg²⁰ about present objects, and Kanzi would interact with Sue Savage-Rumbaugh through a lexigram board with more than 300 symbols, and would obey complex verbal instructions without the use of gestures.²¹ Alex developed a vocabulary of more than 100 words, identified 50 different objects, and recognized up to seven quantities, seven colors, and five shapes. He understood the difference between small and large, equal and different, and above and below. Through verbal instructions, he could identify and correctly choose a square yellow object from among other different shapes and colors. Alex and Kanzi did not only *repeat parrot-fashion or imitate like apes*; rather, they proceeded with reason and abstraction; the dedicated researchers demonstrated that they were capable of identifying, choosing, and manipulating words, phrases, and objects.²² Now: what use do these linguistic skills, revealed in laboratories, have in the natural world?

Vervet monkeys in the African savanna (*Cercopithecus aethiops*) issue a particular cry when spying a leopard. When they hear that sound, the other monkeys quickly climb into the trees. If an eagle appears, the sentry monkey produces a different alarm call and the listeners look up while hiding among the bushes. Finally, when one of them sees a snake, they emit a third call and the listeners adopt a two-footed stance and inspect the ground. These different behaviors even occur in the absence of a predator when each of these sounds is reproduced from a previous recording.²³

¹⁴ See “Icon, index, symbol” (Translated into Spanish by Sara Barrena): <http://www.unav.es/gep/IconoIndiceSimbolo.html>

¹⁵ The concept is largely established thanks to a name. In the proposal by Saul Kripke, the name is a *designator* that refers to an object. When he refers to the same entity in all possible worlds in which that entity may exist, it is called a *rigid designator*. See Saul Kripke (1978) *Identity and necessity*. Translation by Margarita M. Valdés. México: UNAM.

¹⁶ In the first verse of “The golem”, which reads: “If [as the Greeks maintained in the Cratylus]/ the name is the archetype of the thing/ in the letters of ‘rose’ is the rose/ and all the Nile in the word ‘Nile’”.

¹⁷ *Conscience and language*. Translation: María Shuare. Madrid: Visor Libros, 1984. Luria examines the characteristics and implications of semantic fields, sets of related terms that provide more precise meanings to their components (page 37 and onwards).

¹⁸ In chapter 32, “Of True and False Ideas” in Book II of his *Essay concerning human understanding* (1690), México, Fondo de Cultura Económica, 1956. Spanish translation by Edmundo O’Gorman, fourth occupant of the 6th seat of the Mexican Academy of the Spanish Language.

¹⁹ The italics here are intentional.

²⁰ Irene Pepperberg (1998). Talking with Alex: Logic and speech in parrots. *Scientific American*, May 18 1998.

²¹ Par Segerdahl, William Fields, and Sue Savage-Rumbaugh (2006) *Kanzi’s primal language. The cultural initiation of primates into language*. Palgrave Macmillan.

²² An historical and philosophical evaluation of language learned by apes can be found in “Problemas en torno al lenguaje de los póngidos” [“Problems around language in pongidae”] by Jorge Martínez Contreras. In: *Una mirada múltiple sobre el lenguaje* [A multiple view of language] (Víctor Manuel Alzaraz, coordinador) pp 135-159. Guadalajara, México: University of Guadalajara.

²³ Dorothy L. Cheney, Robert M. Seyfarth (1998) *How Monkeys See the World: Inside the Mind of Another Species*, University of Chicago. From the same authors in Spanish, see: “Mente y significado en los monos” in *Investigación y Ciencia*, topic 32: La conducta de los primates, pp 56-63, 2003.

Now, in order to consider these vocalizations as words, it would be necessary to determine whether the voice is preceded by an intention or desire to advise, as although the vervet monkeys ostensibly classify the three vocalizations according to the object that denotes them, perhaps the issuer does not have an idea of the mental state of their audience and marks a stimulant without having the self-awareness, *heteroconsciousness*, or otherness presupposing human language that implies a communicative intention. The capacity to infer external emotions, intentions, or motivations is what constitutes the perhaps unfortunately named "theory of mind",²⁴ and there are indicators of this capacity in many species, such as social games, tactical tricks, or so-called Machiavellian intelligence in chimpanzees and their intrinsic political social strategies, which have been qualified as such by the eminent contemporary ethologist Frans de Waal.²⁵

Other behaviors suggest ritual symbolization in chimpanzees and bonobos.²⁶ These include "funerary rituals" (unusual, emphatic, directed, and iterative behaviors in reference to the carcass of a fellow chimpanzee); a "rain dance" (peculiar rhythmic movements when the first rains of the season start or just before a downpour); the "dolly game" (the adoption of an object which is treated like an infant by the juvenile female chimps); and "pointing behavior" (directing the hand or index finger to call others' attention towards a particular and distant object, which as we have already seen, Lev Vygotsky considered the core of language).

In 1982, Nicholas Humphrey proposed that the origin of human consciousness crucially depended on the capacity to attribute and share experiences in apes and hominids, especially those that lived in groups and depended on others to survive.²⁷ Robin Dunbar proposes that humans' large brains and cognitive skills have evolved through intense competition and increasingly elaborate social strategies.²⁸

The appearance of *Homo sapiens* in external representations and petroglyphs some 70 thousand years ago in groups that were already distributed worldwide, in rock paintings or musical instruments marks an abstract symbolization and communication whose direct relationship with the development of the frontal lobe of the brain has been repeatedly stressed.²⁹ Roger Bartra (2007) suggests that these external symbolic manifestations, which he calls cultural or exocerebral protheses, are an evolutionary resource of hu-

man conscience.³⁰ In 1976, Julian Jaynes had argued about the recent origin of human conscience with the requirement of language for episodic memory and especially reading and writing.³¹ In both cases it was about sentient consciousness, as the feelings and sense of sentient consciousness have a much more remote origin in the evolution of the species.

The oldest indications of symbolic human expression have been found in recordings in Blombos Cave, South Africa, which date back 77 thousand years. The later petroglyphs present clear signals of sentient consciousness because they show animals painted from memory, masks which reveal representation or simulation, and human figures which seem to organize a narrative. This type of representation can be considered adaptive as they are based on neuronal circuits that generate cognitive resources in coordination with the means.³² The archeological, historical, and ethnographic evidence indicates that human cultural systems have had a high level of convergent evolution. The complex hierarchies and ceremonies surrounding the ruling classes, use of rare minerals as jewelry, pyramids with funerary chambers, and many other common elements between distant and unrelated civilizations all show a cultural convergence that includes symbols such as the *axis mundi*, the mandala, and many more. In addition to cultural materialism, which proposes a practical, efficient, and useful basis for the convergent characters between cultures,³³ a cognitive-affective-imaginative, sometimes called *spiritual* necessity also had to be argued, to explain the symbolic convergence. This must be based on a tendency to attribute meaning to natural objects through a communication that gave origin to conscious group content and aesthetic manifestations. Symbolic convergence supposes that certain meanings, emotions, values, and motives for action are co-created by individuals that try to give meaning to a common experience and which are manifested in the construction of social imaginings and rhetoric through cohesive interaction.³⁴ This happens with music or language, which have evolutionary elements and common cognitions for the species, but which are revised in the language or particular manifestations of those to which the individual is exposed in their development.

In *Human Universals*, 1991, the anthropologist Donald Brown³⁵ revised a series of comparative investigations between diverse cultures to show that all human languages and cultures express metaphors, personify external phenomena, mark a territory known as home, cook, outlaw in-

²⁴ In a classic experiment, a chimpanzee called Sarah was shown photos of a person in a cage and in different situations to be able to reach (or not) a banana outside of the cage. If the chimpanzee can put itself in the place of the person, it should signal which photograph showed the possibility of reaching the banana. Sarah passed the test satisfactorily. David Premack y Guy Woodruff (1978): Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1, 515-526.

²⁵ See also *Primates y filósofos* translated by Vanesa Casanova. Editorial Paidós, 2007.

²⁶ James B. Harrod (2011) A Trans-Species Definition of Religion. *Journal for the Study of Religion, Nature and Culture* 1749-4907 doi:10.1558/jsrnc.v5i3.327.

²⁷ Nicholas Humphrey (2001) *The inner eye*. Madrid: Alianza Editorial.

²⁸ Robin Dunbar (1997) Grooming, Gossip and the Evolution of Language. Harvard University Press.

²⁹ See Dunbar, op cit.

³⁰ Roger Bartra (2007) *Anthropology of the brain. Consciousness, culture, and free will*. México: Fondo de Cultura Económica.

³¹ Julian Jaynes (1976) *The Origin of Consciousness in the Breakdown of the Bicameral Mind*. Toronto: University of Toronto Press. Translation by Agustín Bárcena: *El Origen de la Conciencia en la Ruptura de la Mente Bícámaral*. México: Fondo de Cultura Económica, 1987.

³² Peggy La Cerra y Roger Bingham (2002) *The Origin of Minds. Evolution, Uniqueness and the New Science of the Self*. New York: Harmony Books.

³³ Marvin Harris (1987) *Cultural materialism*. Madrid: Alianza Editorial.

³⁴ Ernst G. Bormann (1985) Symbolic Convergence Theory: A Communication Formulation. *Journal of Communication* 35(4):128-138.

³⁵ Donald E. Brown (1991) *Human Universals*. New York: McGraw-Hill.

cest and intra-group violence, practice divination, and have competitive games, etc. Among these universal features, the most interesting in terms of the nature of language is the metaphorical and symbolic capacity of the human brain, which drives neuroscience of language.

3. BRAIN AND LANGUAGE

The history of the cerebral basis of language began in 1861, when Pierre Paul Broca attended a conference of the Paris Anthropological Society to show the brain of a dead person who had aphasia and whom they called *Tan* because that was the only syllable he could pronounce. Tan's brain had a circumscribed lesion at the foot of the first frontal gyrus of the left hemisphere. To this day, that zone is known as Broca's area and it is crucial to speak and articulate language, including signs.

The modularity of language³⁶ was reaffirmed some years later with the discovery of Wernicke's zone for language comprehension, conveniently situated in the first left temporal gyrus, just behind the auditory reception zone. The two areas are joined by a thick bundle of fibers, called the arcuate fasciculus or *arcuate*,³⁷ and they work closely together. The left lateralization is manifest for grammar and vocabulary, but the current linguistic map of the brain is more bilateral and indicative of a complementary hemispheric specialization. Pragmatic, connotative, and affective faculties of language such as prosody, accentuation, and connotation involve right hemisphere activity, and reading and writing requires the participation of multiple sensory, motor, affective, and volitive zones in both hemispheres.³⁸

The preference for using one hand for fine motor tasks and the cerebral lateralization of grammatical and semantic functions are two associated and distinct facts in humans, whose dominance for language and right-hand skill especially involve the left hemisphere in 90% of the population. Right dexterity,³⁹ fabrication of tools, use of symbolic language, and left hemisphere predominance are capacities and characteristics that are linked, which emerged during

the human split from apes some 2.5 million years ago.⁴⁰ The early and complementary division of labor between two hands, necessary for the fabrication and use of tools, was accompanied by a hemispheric specialization, as each side of the body is controlled and perceived by the opposing hemisphere in the brain. Given that both language and the use of tools require fine, sequentially coordinated movements, it was advantageous during evolution that these were associated with a single hemisphere in terms of a superior temporal and sequential motor capacity, both for control as well as processing speed. The most attractive hypothesis of this notable and significant association between manual and linguistic skill would affirm that lateralized gesticulation which preferentially implied the use of the dominant hand was associated with verbal symbolization in the contralateral hemisphere.⁴¹ The bond explains why individuals gesture more with their right hand when speaking, and why Broca's aphasia is always accompanied by paralysis of the right arm. The decisive coalition probably involved so-called *mirror neurons* that activate when performing a movement or observing others doing so, and which were originally detected in primates in zones similar to Broca's area in humans.⁴²

As well as neurology, linguistics have come to enrich the panorama of neurobiology of language. Towards the mid-20th century, the well-known libertarian linguist and political scientist Noam Chomsky, one of the most celebrated patriarchs of cognitive science, strengthened the theory of a universal grammar by Wilhelm von Humboldt, who was himself called the father of linguistic theory.⁴³ Chomsky considered that behind every phrase uttered, there is a formal abstraction related to its meaning. All languages possess a common nucleus; a profound structure formed in a *cerebral device for innate organization*, acquired during the evolution of the hominids. This nativism implies specialized cerebral modules and is supported in evidence that language functions are processed in modules such as Broca's area or Wernicke's area.⁴⁴ However, today we know that the partial modality of mental functions such as language certainly exists, but it is overtaken by the link and integration of functions necessary for consciousness, knowledge, and meaning.

³⁶ The thesis of cerebral modularity, the functional specialization of areas, nuclei, and regions of the brain has been expanded to mental processes, particularly in *Modularity of Mind* by Jerry Fodor (Translated into Spanish: Madrid, Morata, 1986).

³⁷ In comparison with other primates, humans have a more voluminous arcuate fasciculus, which suggests that it has had an important role in the more recent evolution of language. <http://lenguaje-comunicacion.com/el-fasciculo-arcuato-y-el-aprendizaje-de-la-palabra-una-critica/>

³⁸ For a review in Spanish of the cerebral centers involved in language, see: Feggy Ostrosky-Solis y Alfredo Ardila (1994) *Cerebro y Lenguaje. Perspectivas en la organización cerebral del lenguaje y de los procesos cognoscitivos*. México: Editorial Trillas. An extensive revision with more than 430 references to research on neurophysiology of language carried out through functional images of the brain can be found in: *Renewal of the Neurophysiology of Language: Functional Neuroimaging* by Jean-François Démonet, Guillaume Thierry, and Dominique Cardebat published in *Physiological Reviews* (January 2005) 85(1)49-95; DOI: 10.1152/physrev.00049. Ventral and dorsal connections of the left and right arcuate nucleus that have different functions in the activity of language have been described in (Price C.J. 2000: The anatomy of language: contributions from functional neuroimaging. *Journal of Anatomy*. 2000;197(Pt 3):335-359).

³⁹ Semantic redundancy is significant from lateralization.

⁴⁰ Marietta Papadatou-Pastou (2011) Handedness and language lateralization: why are we right-handed and left-brained? *Hellenic Journal of Psychology*, Vol. 8, pp. 248-265.

⁴¹ Both the gestures of Christian prayer and the mudras of the Buddhist tradition show rhetorical positions with the right hand, with well-established meanings in each tradition.

⁴² Rizzolatti G., Arbib M.A. (1998). Language within our grasp. *Trends in Neurosciences* 22(4)151-152.

⁴³ Wilhelm von Humboldt. *Escritos sobre el lenguaje*. Edition and translation by Andrés Sánchez Pascual. Prologue by José María Velarde. Ediciones Península 1999. Carmen Galán Rodríguez affirms that Humboldt's concepts of "internal form" and "energeia" have come to be considered key in modern linguistics (<file:///C:/Users/Dr%20Diaz/Downloads/Dialnet-LaTeorialinguisticaDeWilhelmVonHumboldt-58813.pdf>).

⁴⁴ Chomsky, Noam (2003) *On nature and language*. Translation by Cristina Piña Aldao. México: Ediciones AKAL.

Celebrated Harvard psychologist Steven Pinker has pushed Chomsky's naturalist innatism in his book *The instinct of language*, proposing that evolutionary theory provides a causal explanation of language, and that it was selected in order to resolve communication problems.⁴⁵ Language is not a form of technology similar to the use of tools, but rather a biological adaptation, like dolphins using sonar or spiders spinning webs, which is plausible but incomplete, as this type of genetic determinism minimizes the social and cultural factors of communication throughout the long trajectory of humans. The language philosopher Jerry Fodor, a collaborator of Chomsky, put forward a central hypothesis for initial cognitive science: thought understood as a computational-type procedure that operates on symbolic representations. There would therefore be a universal and specific language of thought, which he called *mentalese*, a system of symbolic representations that occurs in the brain and which would explain the ability to understand, process, or engender phrases never before heard or pronounced,⁴⁶ one of the most astounding properties of human linguistic capacity.

These theories concur with the ancient rationalist view so closely linked to Kant, that the mind is not born empty of content, nor does it capture the world as a *tabula rasa*, but rather it comes equipped with programs or tendencies that evolutionary psychology has considered general shapers of human cognition. Without going into excessive detail on these notions, another notable idea is that humans come into the world endowed with domain-specific programs that are dependent on context and which are specialized to solve problems faced by our ancient ancestors. Even if the idea that certain behaviors and knowledge resemble provisions of the human species seems acceptable, a more difficult question is whether there exist concrete symbols of ancestral origin or archetypes that code or favor content expressed with the vestments of language, aesthetic representation, and particular cultures of groups and individuals.

Many of the universal programs of language operate unconsciously and it is likely that they are coded in neuronal networks acquired in ancient times in a way that is lax but effective. Conscious and explicit mental processes rest on a support structure of archaic processes that the prominent neurologist Antonio Damasio considered the nucleus of conscience.⁴⁷ It is through this that the emotional imagery of myths, dreams, or hallucinations has been attributed to a deeper and more anciently-acquired cerebral physiology than the parts of the neocortex that are the foundation of human rationality.⁴⁸ These theoretical contributions are subject to revision and adjustment by cognitive neuroscience, but

there has been a spectacular development of techniques for cerebral exploration in human subjects that carry out carefully-calibrated cognitive tasks. Among these techniques are electro- and metabolic cerebral imaging. It is worth referencing certain investigations that are relevant to language processing that were carried out using these methods.

Recent neurocognitive research seems to clarify some characteristics of meaning. For example, the tradeoff between those who considered that the meaning of a word is in the mental image associated with it and those who proposed that it is a purely linguistic abstraction could be better understood by the so-called *concreteness effect*. This refers to all behavioral and neurophysiological difference related to the processing of words in terms of the level of concreteness or *imaginability* of their meanings. The effect manifests itself with more speed (less reaction time) and greater precision (fewer errors) when processing concrete words that quickly evoke images. In this way, there is a gradient of concreteness from the terms associated with images to those which are most abstract. On the other hand, words with an understandable meaning evoke more complex auditory potential in the brain than words with no sense, and this is notable in a deflection of the potential caused which occurs around 400 milliseconds after the presentation of the word. This potential, called N400, is associated with capturing the meaning of words. It is recorded with a greater dimension in the language zones, and it is wider for concrete words than it is for abstract words.⁴⁹

In an ingenious study of the fascinating "tip of the tongue" phenomenon, through electromagnetic brain scanning, psychophysicists from the University of Santiago de Compostela found that sequential activation of a network of parietal and medial temporal areas, the insular cortex, and prefrontal areas is necessary for successful recall of the names of famous people presented in a series of photographs. When the subject recognizes the person but does not remember their name and says it is on "the tip of their tongue", this network is not activating in all areas, or in the correct sequence. Searching for the name for more than one second implies activity in the anterior cingulate and a frontal network involved in semantic memory.⁵⁰

In another type of experiment, it has been detected that there are neurons situated in the temporal lobe that respond

⁴⁵ Steven Pinker (2012) *The instinct of language*. Translation by José Manuel Igoa and Alejandro Pradera. Madrid: Alianza Editorial.

⁴⁶ Jerry A. Fodor (1985). *The language of thought*. Madrid: Alianza Editorial. See also the evaluation of meaning from a current psychological perspective in "La sonrisa del gato de Cheshire y el concepto del significado en psicología" by Víctor Manuel Alcaraz Verduzco. In: *Una mirada múltiple sobre el lenguaje* [A multiple view of language] (Víctor Manuel Alcaraz, coordinator), pp 241-270. Guadalajara, México: Universidad de Guadalajara.

⁴⁷ Antonio Damasio (2000) *The Feeling of what Happens*. Santiago: Editorial Andrés Bello.

⁴⁸ Erik D. Goodwyn (2012) *The Neurobiology of the Gods: How Brain Physiology Shapes the Recurrent Imagery of Myth and Dreams*. New York: Routledge.

⁴⁹ José María Ruiz-Vargas e Isabel Cuevas (1994) Imágenes mentales y memoria: hacia una explicación del efecto de concreción. *Cognitiva* 01/1994; 6(1):3-25. DOI:10.1174/021435594321237810. A broad assessment of the potentials invoked in the study of language can be found in: Harmony Baillet, T., Silva Pereyra, J. (2000) Estudio del lenguaje por medio de los potenciales relacionados a eventos. In: *Una mirada múltiple sobre el lenguaje* [A multiple view of language] (Víctor Manuel Alcaraz, coordinador), pp 271-295. Guadalajara, México: Universidad de Guadalajara. Figure 20 is taken from: Castro Salas, M. A. Potenciales Relacionados con Eventos (PREs) durante la percepción de palabras abstractas y concretas. Master's Thesis, Institute of Neurosciences. University of Guadalajara, 2008.

to the names of particular people and places. At the end of the 19th century, William James predicted these theoretically, with the patriarchal name of "pontifical cells", later called "gnostic neurons". It happens that these cells respond not only to the name of a known person, but to the various images, poses, or characters they interpret. There has also been the name the "Marilyn Monroe neuron", for the cell which activates when various images of the diva are seen, but also when she is seen from the back, or when her name is heard or read.⁵¹ In spite of this sensational finding, it should not be concluded that concept, representation, or meaning resides in a neuron, but that the neuron is indeed a crucial node in a genetically arranged network, which is conditioned by repetitive learning to process information about a person or object, centrally linked to concept.

It has also been discovered that verbs and nouns activate different parts of the brain. Verbs which imply actions fire up frontal zones close to the motor regions which guide movement, whereas nouns which designate objects activate the temporal lobe cortex between the auditory and visual regions and which are crucial in identifying what it is that is being heard or seen. A group of Russian researchers⁵² reported in April 2014 that verbs and nouns which implicate actions such as *to jump, to throw, kick or dance* induce the activity from the portion of the motor cortex specifically implicated by the meaning of those words: the leg zone. This happens some 80 milliseconds after hearing or reading the words, much before the subject captures the meaning, which as we have already seen, occurs after 300 milliseconds. This process constitutes a neural foundation of semantics, as the specific motor circuits are automatically committed in the meaning of these words. Consistently with this, a group of British neuroscientists have visualized the brains of 12 healthy volunteers when hearing common phrases, jokes, or word games. They observed that reward zones are activated much more intensely with jokes or word games than with common phrases, and the response is proportional to how funny the subjects found each of the jokes.⁵³

During a functional MRI study,⁵⁴ 15 Christian and 15 non-believing volunteers declared their true or false belief on statements that were both religious (e.g., "angels exist") and non-religious (e.g. "Alexander the Great was a famous military leader"). The cerebral images of the believers and non-believers were indistinguishable, which suggests that the assessment of being true or false is independent of con-

tent. Even if, from a phenomenological and semantic point of view, it is very different to believe that angels exist and that Alexander the Great was a great warrior, in the moment, the brain does not distinguish further than the act of believing and not the content. Other experiments have shown that the same cerebral areas are activated during the processing of both literal and metaphorical phrases, insofar as the qualitative consciousness of one and another is clearly distinct.⁵⁵ As can be seen, there is much still to know in terms of differences in the contents of verbalizations and beliefs; in other words, the content of mental representations, but we already know that meaning is not associated with a model, but rather that it is attached to the zones of the brain whose functions are alluded by the word or statement. It is in this way that meaning is based on primary functions of the body and its brain, but what does it consist of, and how does representation occur?

4. REPRESENTATION AND MEANING

Neurophysiologists use the concept of *representation* to refer to neurons or nervous sectors which activate during the execution of a specific cognitive task and in particular, to spacio-temporal guidelines of the neurons' electrical activity which thereby code and transmit contents of information.⁵⁶ It is permissible to suppose that these codes of nervous activities are constituted in cognitive information processes because they are the base of a pyramid that includes growing levels of organization in networks, modules, and intermodular activities in the whole brain, and they correspond to levels of cognitive elaboration. In this structure, the emergence of symbolic representations can be proposed on the basis of the neurophysiological representations, and a correlation can be set out between conscious processes and cerebral processes of a high level of integration, in that they constitute two aspects of a procedure of psychophysical nature.⁵⁷ Mental representations are therefore rooted in levels of organization, from the most basic corresponding to the sensory projections of objects in the world, passing through an intermediate level of categorical representations learned from unvarying features of objects, through to an integrated and emerging level of superior representations that are properly symbolic and semantic. In this way, the following neurosemantic hypothesis can be proposed: nervous representation is based on codes triggered by neurons that are organized into complex networks, that

⁵⁰ Santiago Galdo-Álvarez, Mónica Lindín and Fernando Díaz (2011) Brain dynamics associated with face-naming and the tip-of-the-tongue state. *Psicothema* 23 (2):189-195.

⁵¹ R. Quian Quiroga, L. Reddy, G. Kreiman, C. Koch. Invariant visual representation by single neurons in the human brain (2005) *Nature* 435, 1102-1107. doi:10.1038/nature03687.

⁵² Yury Shtyrov, Anna Butorinad, Anastasia Nikolaevad, Tatiana Stroganovad (2014) Automatic ultrarapid activation and inhibition of cortical motor systems in spoken word comprehension. *Proceedings of the National Academy of Sciences*. doi: 10.1073/pnas.1323158111.

⁵³ Mobbs, D., Greicius, A., Eiman, M. V., Reiss, A.L. (2003) Humor Modulates the Mesolimbic Reward Centers. *Neuron* 40 (5): 1041-1048.

⁵⁴ Harris S., Kaplan J.T., Curiel A., Bookheimer S.Y., Iacoboni M. (2009) The Neural Correlates of Religious and Nonreligious Belief. *PLoS ONE* 5(1): 10.1371/annotation/7f0b174d-ab93-4844-8305-1de22836aab8.

⁵⁵ See the article "This Is Your Brain on Metaphors" de Robert Sapolsky in the *New York Times* of November 14, 2010.

⁵⁶ For neurophysiology, electrical activity of neurons constitutes "the language of the brain"; see for example: *Lenguajes del cerebro* by José M. Delgado García, Editorial Letra Áurea, 2006.

⁵⁷ J.L. Díaz (2007) *La conciencia viviente*. México: Fondo de Cultura Económica.

content is determined by the origin and destination of the pathways between the various modules of the brain, and finally that meaning is defined by the dynamic pattern of interconnections between the modules, all of which is intimately associated with the body's perceptive and motor systems.⁵⁸

The swarm hypothesis⁵⁹ proposes that the intermodular dynamic of the brain is necessary for consciousness and for meaning, as it is a super-organized process of spacio-temporal activation. According to the eloquent metaphor by that pioneer of modern neuroscience, the Spaniard Ramón y Cajal, just like swarms of insects and flocks of birds, the intermodular dynamic of the brain is apt to navigate, swarm, cry, split, or flow through the brain and link together its diverse subsystems quickly and effectively in the manner of "bustling hives". In accordance with this property, conscious processing is capable of agreeing, coordinating, and integrating multiple local mechanisms of information, as happens, for example, when a memory is integrated with a mental image, a thought, and an emotion - operations segregated into distinct substrates and nervous modules which are joined in a single content and process; in other words, as a conscious experience.

Conscious process is the mental aspect of neurological performance of the highest level of integration, a phenomenon with clear causal capacities on the functioning of lower-hierarchy systems which mold speech and expression of behavior in general. In addition, this expressive capacity of conscious systems by means of language and the action of the individual has diverse and potentially transcendental effects on the social and cultural system. This is clear for the creative activities that are produced as a conscious process and which are later captured or expressed through acts, symbols, scientific theories, art or technical products towards the social, cultural, and ecological environment.

External physical patterns, such as oral or written language, music, or social imagery including plastic arts, constitute transcendental codes of information which overtake the subjects to remain or be displaced in time and space. These patterns can be conceived as homologous with the cerebral operations that assimilate, transform, or express them, which is the basis of patterned process theory.⁶⁰ These processes, among which stand out the brain's flow of connectivity, the sequence of acts which form the expression of behavior, or the processing of mental elements that characterize consciousness, would be transformations of information that permeate between the social and neurobiological systems to achieve and share cognitive operations. These patterns cannot be physically identical in their course by the various means and support and the resulting information uses multiple channels and undergoes transformations between the biological systems, environmental niches, and

social expressions. This exchange of mental information occurs thanks to behavior and sensitive-motor systems; crucial pieces situated between the brain and the world.

The elements in transition in these pattern processes have a narrative and cinematic architecture defined by units (notes, words, acts) which occur in certain sequences (melodies, phrases, activities), combinations (harmonies, gesture-word fusions), rhythms (cadences, accents), and qualities (timbre, connotations). They are shapes in movement which unfold in time with a probability of semi-ordered or stochastic transition, with an intricate rhythmic frequency, a wide combination of units, and a qualitative factor of modalities particular to each defined process, as with qualities of consciousness. The case of music is a paradigm of a patterned process as it is involved in the nervous function to allow emotion and musical figuration from the correspondence between the ondulatory spacio-temporal structures of a sound arrangement and certain spacio-temporal structures of cerebral processing in between the behavior to produce the sound and the auditory system to perceive it. In this way, music is not only a creative expression of certain affective and figurative mental activities in itself. It is also essentially an external sound formation that is complementary to an emotion or internal figuration which acquires a "musical" form. When this is played or interpreted, it is scattered by the elastic medium of the air as a prolongation of certain cerebral circuits and processes, and allows certain musical emotions to be shared between the composer, the interpreter, and the listener. The emotional effects of music as such require symbolic mechanisms of high hierarchy of the brain, functioning or resonating in unison with world visions and cultural patterns.

5. LOGOS RECOVERED

The Spanish-Mexican philosopher Eduardo Nicol recovered and updated the Logos of Heraclitus as the symbolic human sphere, and he gave robust arguments that it is not a hermetic and private capacity, but rather it is visible in the world of culture. In *La metafísica de la expresión* [The Metaphysics of Expression], 1957, Nicol restored symbolic function as the essence of expression and its communication between human beings as the linking mechanism of culture.⁶¹

In this sense it should be indicated that the symbolic process -Logos, the Verb- is a common and natural element to culture, consciousness, and the brain, and it needs to be explained in terms of cerebral processes that manage to hold meanings or symbols. The external or cultural symbol is a dual stimulus in the sense that it codes a bond with the object on the one side and the agent on the other. According to biogenetic structuralism,⁶² the meaning of the symbol is

⁵⁸ See Díaz (op cit. 2007: 436-443) and the introduction in the book by S.W. Kuffler y J.G. Nicholls (1976) *From Neuron to Brain*. Sinauer Associates, Sunderland.

⁵⁹ Díaz, op cit (2007: 445-474).

⁶⁰ Díaz, op cit (2007, chapter 11).

⁶¹ Eduardo Nicol (1957) *La metafísica de la expresión*. México: Fondo de Cultura Económica.

measured by cultural processes connected to cerebral processes through a practice, in such a way that the complementary elements would be a particular cerebral process on one side, and a behavior developed and learned in the cultural environment on the other.

Something unknown and disconcerting unites the mind and the body, the conscious and the brain, the meaning and the neuronal swarm; something that must form a unity, a psychophysical reality which has challenged and stubbornly avoided human understanding. In order to conceptualize this unity, we need to consider that consciousness has an organic nervous root or base that is very specific, given that the brain generates this natural property accommodating and manipulating the environment through the distinctive peculiarities of that marvelous organ. Its system boasts the most complex communication system known to man and attempts are being made to unravel its connective anatomy in the huge *Connectome* project.⁶³

It is a formidable challenge, as like meanings, conscious mental events possess a phenomenological and subjective nature that differs drastically from the electrochemical events that occur between neurons. This opening is the hard core to crack in the mind-body problem, as even if we manage to detect the phrases thought by a subject upon successfully decoding their corresponding electrical signals in the brain using an ingenious *cerebroscope*, that would not constitute a true reading of the mind and experience, but rather an indirect and partial reading of its contents, among which the precise meaning of the words would be excluded for the thinking subject, as well as all the accompanying qualitative, intuitive, emotional, prospective, and intentional aspects of their concern. In *Cahiers/Notebooks* of 1920, Paul Valéry wrote: "these thoughts I write are not the thoughts I have", which means that the enunciation of thought itself in the form of natural language restricts, diminishes, or even betrays the thought itself as it was felt or experienced, an idea passionately expressed by Rosalía de Castro in the summary of this conference.

Furthermore, to adequately translate the cerebral activity in mental activity, it is necessary to establish a bi-unambiguous relationship between a mental and a cerebral process.⁶⁴ But that is unlikely, as the same mental acts can be carried out by different neuronal networks, just like how in reverse, the same network can, according to synaptic or neurochemical variations determined by their history, car-

ry out various mental acts, which is very obvious in the recovery of functions lost through cerebro-vascular accidents. The cerebroscope would require an unheard-of type of hermeneutics, an interpretation technique that would crucially depend on the meanings of the cerebral signals being duly established. Furthermore, to make the correlation, resorting to the first-person report of the subject would be inevitable; it is the traditional mechanism for knowing the mind of others and, already employed by Homer, it reached an expressive peak in the interior monologue developed by novelists such as Virginia Woolf or James Joyce.⁶⁵

At this point, I ask for one more mental exercise from the listener or reader of this text, and that is for you now to picture your most beloved ancestor. In my particular case, if I think about my dear Grandfather Juan, an upright Galician country man called "Grandpa Juanito" by his children and grandchildren, what springs to my mind are not just images or sensory scenes, especially visual and auditory memories from 60 or more years ago. What also occurs in close association with them are feelings, intentions, fantasies, and thoughts in an internal language, either in the voice of my dear grandfather or in the form of a parallel commentary to the experience by an elusive version of me. A transcription of the words that pass through the mind would be an extraordinary achievement, which would perhaps partially reach into the neuroscience of the future, with all the dangers that implies. But it is still insufficient to reveal the mental experience and the multi-faceted meaning that the words "Grandpa Juanito" have for me, or that the person conjured up in the mind of the reader or listener would have for you in the intimacy of consciousness.

From this framework of evoking my forebears, I conclude with cautious enthusiasm, as the oxymoron goes. The nascent contribution of biological, cognitive, and cerebral sciences, coordinated with humanistic disciplines to understand the nature of language and the meaning of meaning is both revealing and challenging. Far from reducing Logos to shared behaviors, cerebral modules, or neuronal networks, it enhances the nature of language with neurological evidence and contrastable cognitive theories. It makes *Homo sapiens* into *Homo loquens* among the significant creatures of Earth, it recognizes the majesty of poetry, and it safeguards the secrecy of symbol and of meaning as a colossal challenge that requires research that is bolder and more creative still.

⁶² *Brain, Symbol and Experience. Toward a Neurophenomenology of Consciousness* by Charles D. Laughlin, Eugene d'Aquili and John McManus (1993) New York: Columbia University Press.

⁶³ Sebastian Seung (2012) *Connectome: How the Brain's Wiring Makes Us Who We Are*. Houghton Mifflin Harcourt.

⁶⁴ Donald Davidson (1980) *Essays on Actions and Events*. Oxford: Clarendon. Translated into Spanish by the Institute of Philosophical Research of UNAM, edited in 1995 by UNAM, and by Crítica with the title of *Ensayos sobre acciones y sucesos*.

⁶⁵ In this respect, see Díaz 2007 (Op. cit. capítulo XV) and *Leer la mente* by Jorge Volpi (México: Alfaguara, 2011).