Review article

Consciousness and language. An interdisciplinary perspective

Conciencia y lenguaje. Una perspectiva interdisciplinar

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Abstract

Background: Consciousness is one of the most complex mysteries that persist at present. Although conscious experience and the properties of consciousness are related to language, the role of the latter is not clear, and we consider it important to point out its limitations and scopes. The objective of this work is to carry out a review of the existing literature on the relationship between consciousness and language, analyzed through an interdisciplinary perspective.

Relevance: Understanding the relationships between consciousness and language will allow us to better understand the processes involved, as well as greater openness to the conscious experiences of people with language disorders.

Conclusions: There is an important relationship between language and consciousness. The implications entailed in their study are bidirectional. A greater comprehension of consciousness and its relationships with language will lead us to a better understanding of the limitations presented by patients with language disorders. More research is required to address the problem, considering the theoretical frameworks, to accurately define what is intended to be studied.

Key words: Consciousness, language, science

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Resumen

Antecedentes: La consciencia es uno de los misterios más complejos que persisten en la actualidad. Aunque la experiencia consciente y las propiedades de la consciencia, tienen relación con el lenguaje, el papel que tiene este último no es claro y consideramos importante señalar sus limitaciones y alcances. El objetivo de este trabajo es realizar una revisión de la literatura existente sobre la relación entre consciencia y lenguaje, analizada a través de una perspectiva interdisciplinaria.
Relevancia: La comprensión de las relaciones entre la consciencia y el lenguaje nos permitirá un mejor entendimiento de los procesos implicados, así como una mayor apertura ante las experiencias conscientes de las personas con alteraciones del lenguaje.
Conclusiones: Existe una relación importante entre el lenguaje y la consciencia. Las implicaciones que conlleva el estudio de los mismos, son bidireccionales. Una mayor comprensión de la consciencia y sus relaciones con el lenguaje, nos llevará a una mejor comprensión de las limitaciones que presentan los pacientes con alteraciones del lenguaje. Se requieren más investigaciones que aborden el problema, considerando los marcos teóricos, para delimitar mejor lo que se pretende estudiar.

Palabras clave: Consciencia, lenguaje, ciencia

Introduction

Over time, consciousness has been approached in different ways. By the end of the 20th century, an unusual interest in the study of the mind and body resurfaced to understand consciousness from scientific methodology. Previously, in the seventeenth century, René Descartes, one of the pioneers of the scientific method and modern science, considered that mind and body were different entities, but which could be related to one another, making room for what we know as dualism.[1] On the other hand, monistic scientists and philosophers consider consciousness because of the physiological processes of the brain, being represented as a unit. Some monists consider it essential to study matter and its physical-chemical properties, as the only way to understand consciousness; this is called materialism. Furthermore, there are other monists who consider studying the brain from evolution in order to grasp how the emerging properties of consciousness appear.[2]

Despite conscious experience is a very vivid phenomenon, it is difficult to conceptualize what consciousness fully encompasses. Sutherland defined consciousness as "having perceptions, thoughts, and feelings. Awareness. The concept is not easy to define in intelligible terms without a grasp of what consciousness means. It is easy to fall into the trap of confusing consciousness with self-consciousness; in order to be aware, it is only necessary to be aware of the external world. Consciousness is an elusive phenomenon;

it is impossible to specify what it is, what it does or why it evolves".[3] The search for a theory on consciousness has become a fascinating journey to unravel one of the greatest mysteries that persist up to modern times.

The role of language in the understanding of consciousness has been discussed from the various standpoints above and the importance each theory assumes is variable. There are assiduous criticisms to how a system is able to understand itself and thereby, how understanding consciousness would be possible. However, we opted for an approach to this phenomenon by trying to elucidate the role of language in consciousness, its limitations and scopes.

Language is the vehicle of conscious-conceptual thinking. Several concepts have been put forward regarding its cognitive functions, which pose a spectrum that ranges from communicative functions, from the simplest point of view, to a conceptual need for all propositional thinking.[4]

Various factors take part in the conscious perception of our sensory experiences. To mention one, mother tongue has an important influence on the modulation of these experiences; for example, by describing the different shades of a color palette.[5] Although in a first analysis vision and hearing may be thought of as the senses most linked to linguistic description (and thus to consciousness), it has been shown that different languages differ in the sensory domains they encode and in way they do it.[6]

Berkovitch and Dehaene propose that cognitive architecture is organized in two different ways (activated unconsciously and in parallel), each organized to exploit a different source of information on syntactic characteristics. On the one hand, a fast path (pseudo-morphological) that examines the endings of words to detect the presence of known grammatical morphemes that index the syntactic characteristics (such as thinking that words ending in "s" are likely to be plural). And on the other, a lexical-syntactic system that indexes the genuine syntactic state of each word (e.g., sibling ends in -ing, suggesting a verb, but the lexicon correctly encodes it as a noun).[7]

Internal language, also described as verbal thinking or imagined discourse, refers to the production of words in the mind of a person, whose recipient is the same person who produces them, or the expression of conscious thinking in a coherent linguistic form. Internal language plays an important role in the interaction of language and thought, facilitates the introspection of thoughts, providing empirical evidence for a positive relationship between language and consciousness.[8] It also has significant participation in executive control, working memory, task change and troubleshooting.[9]

Research on consciousness and the implications of language has been resumed by areas such as physics and related fields. Though we will not mention these theories in depth but some opinions on them, for knowledge in these fields is very vast.

Penrose and Hameroff explore the link between Quantum Physics and Consciousness.[10] On the one side, they propose that consciousness may be the result of quantum processes regulated by collections of microtubules found in brain neurons and that these processes are intertwined to regulate neural activity. On the other, they comment that just as neurons are intertwined, they may also be intertwined with other quantum processes in the universe. However, Moretta argues that the lack of consensus on the most basic aspects of Quantum Physics makes addressing the nature of consciousness in terms of quantum mechanics implausible.[11]

A holistic comprehension of consciousness that transcends the study of human mind can translate into a better understanding of it and its most relevant characteristics such as language. Advances in artificial intelligence hint that it is learning that gradually increases the sophistication of self-organized systems, thus the sophistication of language.[12]

Language and higher-order consciousness

Edelman and Tononi put forward that conscious perception is not "perceiving" something, but rather the resurgence of stored memories (information) that have been and are being correlated and reinforced by neurological exchange and "re-entry" between various information nodes. Our current conscious experience is a remembered series of previous perceptions, a "remembered present" with its significance and meaning created by reinforced neurological clues.[13]

Consciousness, according to Edelman and Tononi, arose because of evolutionary innovations in the morphology of the brain and body. Edelman refers to the bases related to a primary consciousness and a higher consciousness. An animal that only has primary consciousness can generate a mental image or a scene based on the succession of actual events that take place in the environment. This animal will have a biological individuality, but not an authentic "self", a consciousness of its own identity. Higher order consciousness necessarily requires social interactions, by means of which a self-conscious agent, or the appearance of the "self", can be built. When full syntax-based linguistic ability appeared in the precursors of *Homo sapiens*, higher-order consciousness developed, partly as a consequence of exchanges in a community of speakers. Syntactic and semantic systems provided a new means of symbolic construction and a new form of memory that mediated higher-order consciousness. Then the consciousness of consciousness became possible.[13]

Consciousness as the result of the formation of semantic pointers and the competition between them

Some working groups reviewed the works of Tononi and Edelman on consciousness as the ability of a system to integrate information. Thagard and Steward argue that this theory raises mathematical and empirical problems. They assert that organisms generate a representation of the world through neural populations (since neurons interact with the world and with each other, tuning into the regularities of the environment), and that these representations, in turn, are linked between them in more complex representations (called semantic pointers), which compete with each other to capture the most important aspects of an organism in its current state.[14]

The representation of these semantic pointers or indicators is based on the work of Eliasmith, who proposes a brain model called "Semantic Pointer Architecture Unified Network",[15] considering semantic pointers as elements of a compressed neural vector space (association neurons with different modal specificity; that is to say, representations that can function as symbols, while maintaining connections with sensory and motor representations). For instance, if the word "chocolate" is mentioned, we associate its color, texture, flavor, etc. and at once, it allows the semantic pointer to make inferences such as that a diabetic should not abuse this product. This

theory helps to explain various psychological phenomena such as inference or pattern recognition.

Based on this model, Thagart and Stewart propose the theory of competition of semantic pointers,[14] which supports on 3 hypotheses:

H1. Consciousness is a brain process that comes from neural mechanisms.

H2. The crucial mechanisms for consciousness are: representation by patterns of firing in neural populations; binding these representations into semantic pointers; and, competition between semantic pointers.

H3. Qualitative experiences result from the competition won by semantic pointers that unpack into neural representations of sensory, motor, emotional and verbal activity.

Consciousness as a dual concept

Chalmers refers that there are two fundamental concepts of the mind: the phenomenal concept and the psychological concept. The phenomenal concept of the mind refers to the mind as a conscious experience and a consciously experienced state of mind. The psychological concept of the mind proposes the mind as a causal or explanatory basis for behavior.[16]

Chalmers considers it is not surprising to deem that consciousness also has a phenomenal and psychological sense. The phenomenal sense is linked to the subjective quality of conscious experience or experience, which is the most difficult to explain and considers a hard problem. The psychological sense can be utilized to refer to a variety of psychological properties considered an "easy problem" such as informativeness or introspective accessibility to information. In this sense, Chalmers groups psychological properties under the title of psychological consciousness in order to distinguish them from phenomenal consciousness. The author refers it is common for someone who formulates an explanation of consciousness to begin by covering the problem with the full gravity of the problem of phenomenal consciousness but ends up explaining some aspect of psychological consciousness.[16]

There is also a list of the varieties of psychological consciousness such as wakefulness, introspection, attention, voluntary control, knowledge, and informativeness. This last refers to our ability to inform about the content of our mental states. It presupposes ability for introspection, but it is more constrained than such ability which recognizes the possibility of using language. All the notions described above are mainly functional. Furthermore, Chalmers adds that the phenomenal and psychological properties close to these notions tend to occur together, nevertheless as with other mental concepts, they should not be merged.[16]

Consciousness and the production of language

Dennet proposes resorting to the use of a model of Multiple Versions, where all the varieties of perception (in fact every variety of thought and mental activity) are carried out in the brain through parallel processes, which run in multiple ways of interpretation and elaboration of the input sensory stimuli. The latter without the existence of a conductor. Regarding language, the author emphasizes as well the lack of chain of command in the brain governing speech production.[17]

Although there are many detailed theories and models of language perception, and of the understanding of sentences perceived by a liste-

ner (the path from phonology, through syntax, toward semantics and pragmatics), there has been no particularly promising model that explains language production systems. On the basis of the above, Dennet exemplifies that his theory is consistent with the presumable "absence of the director", as regards the production of language. This is to dismantle what he calls "Cartesian theater", where he refers that a homunculus, or little man, is not necessary to direct the events or processes.[17]

On the problem of qualia, which are referred to as the subjective qualities of individual experiences, Dennet merely comments on some examples. He refers to Naegel's well-known proposal, about the question, *What does it feel like to be a bat?* denoting the impossibility of knowing what it feels like. In the same vein, he comments that it is difficult for a normal listener to know exactly what the consciousness of a deaf-mute would be like.[18] He mentions that when a deaf-mute acquires language (sign language, which is the most natural language a deaf-mute can learn), a complete human mind opens, clearly different from the mind of a person who can hear, but with the same ability to produce complex reflections and with the same generative power. Without natural language, the mind of a deaf-mute would be severely limited.[18]

Consciousness and its implication in aphasias

From the first contributions of Broca and Wernicke to the development of neuropsychology by A.R. Luria, the approach of aphasias has allowed identifying different cortical regions involved in the processes of understanding and generation of language. In spite there is evidence that consciousness is detectable in up to 10-20% of people with brain injuries that do not respond to external stimuli,[19] no specific brain regions have been identified as responsible for self-awareness and consciousness of the self at its environment; so the study of the mechanisms of language (and its alterations), such as the ability to express this understanding, could bring us closer to a better understanding of the brain mechanisms involved in consciousness.

There is no consensus about the need for consciousness for high-level cognitive processes. It is suggested that certain highly complex tasks (such as the perception and understanding of language) can be performed unconsciously. Nigri et al. demonstrated that automatic lexical processing can be preserved in minimally conscious states.[20] Rolls et al. collected evidence that low-level perceptual characteristics, such as sentence length and alphabet familiarity, could be processed unconsciously.[21] Even in situations where the ability of the brain to process language has been severely affected (as in the case of global aphasia), the presence of certain cognitive abilities has been demonstrated. However, in all of these studies there is a degree (even if very low) of consciousness.[22]

Discussion

In addressing consciousness and language, we come across different paradigms and ways of thinking. There are various authors who by means of their thinking have allowed us to analyze not only philosophical approaches, but also scientific efforts on this topic. Some authors' contributions that we consider relevant due to the broad theoretical framework to which their theories subscribe, as well as points of controversy, are discussed.

Edelman and Tononi give language a relevant role in the development of higher order consciousness. Said consciousness appears as an emergent property, which according to its evolution becomes more elaborate. In this way, they make a distinction between the primary consciousness of an animal and the higher order consciousness of humans; this last enables a great variety of connections and the emergence of the properties of consciousness. The authors also mention that the emergence of a "self" allows conscious experience to expand. The authors reject dualism, extreme materialism and reductionism. The metaphysical and epistemological positions adopted by the authors were called limited realism and biologically based epistemology, respectively. They argue that the notion of concepts are not propositions of a language, but rather constructions the brain develops by mapping its own responses to language. From stand point of the researchers, concepts precede language, which is developed by epigenetic means to enhance future conceptual and emotional exchanges.[13]

On the other hand, we find Chalmers' theory, which gives language a secondary role for the study of consciousness. He considers that language is relevant to explain the psychological properties of consciousness, not the phenomenal properties of the conscious experience, which he considers the main problem or the "hard problem" to explain consciousness.[23] Chalmers himself considers this theory dualistic, though not entirely Cartesian, since he states it as a dualism of properties. There is, according to this author, an explanatory gap between physical level and conscious experience. Even so, physical facts are still relevant to explain consciousness. He refers that perhaps some kind of explanation can be obtained by combining the underlying physical facts with certain bridging principles that link physical facts with consciousness. He emphasizes that theories such as Dennet's do not provide a reliable explanation of qualia. On the other side, Chalmers criticizes some points related to the evolutionary theory of consciousness, of which Edelman is a supporter. He comments that evolution selects properties according to their functional role and is irrelevant for the explanation of the bridging principles by virtue of which some of these systems are conscious.[16]

Dennet approaches language noting that no homunculus is required to direct language production. He does not use language to explain consciousness like Edelman, though does use it as a tool to elaborate metaphors that are useful for him to address the problem of qualia. He mentions there are physical properties that do not require a more in-depth explanation, albeit he does not rule it out, since it would not be an obstacle to begin to envision a theory of consciousness at the moment.[17] Dennet's main criticism to Chalmers is that his strategy of dividing problems related to consciousness into an "easy problem" of consciousness and a "hard problem" of consciousness is not adequate and generates confusion. Dennet argues that the study of the "easy problem" cannot be advanced without responding to the "hard problem" in this process as well. In like manner, this author refers that, for example, in the case of qualia, if we do not begin by decomposing them into their functional components from the beginning and distributing them along a theoretical model, we would have a bigger problem.[24]

Despite the various approaches, it becomes clear that consciousness and language, especially internal language, are closely related. Consciousness as the ability of human beings to perceive reality and recognize themselves in it, and langua-

ge as the vehicle through which the ideas, thoughts and sensory experiences, which make up the reality the individuals recognize and in which they (individuals) recognize themselves, are channeled. This we could frame within what Edelman refers to as higher order consciousness.

It is worth questioning how the degree of language disturbances such as aphasia or other disturbances in language development limit the way an individual perceives themselves and their reality (for example, the inability to describe an emotion, a need or a feeling). Just as in the rehabilitation of aphasias, the semantic aspect of language (the ability to name the environment) is assessed, it may be convenient to assess this "metacognition" of the patient (how he/she perceives himself /herself), and the ability to express such perception. Therefore, the study of consciousness should be considered in the rehabilitation of language problems.

Consciousness, therefore, becomes elusive to us, just like the definition presented at the beginning. However, far from discouraging us, unraveling the mystery that the understanding of consciousness entails is a challenge whose path is exciting just to walk. As a ray of light that falls on a mirror and reflects its image and brightness; in this sense, human beings through consciousness bounce off themselves and become observers and observed. By inquiring on consciousness, we inquire on a reflection about ourselves. Language becomes the tool from which the imagination and elucubration of theories arise.

Conclusions

There is an important relationship between language and consciousness. The implications involved in the study of them are bidirectional, since the study of consciousness would allow us to better understand language and its properties, while the study of language focuses on the study of the conscious perception of the individual and his/her reality. We consider language as a vehicle that allows us to travel and develop theories on consciousness, but does not explain a causal relationship with it.

From a clinical point of view, a greater understanding of consciousness will lead us to a better understanding of the limitations presented by patients with language disorders. In the future, with the development of new techniques for neuroimaging, neurophysiology and neuropsychology, it may be possible to visualize other paths in the approach to consciousness. More research is required to address the problem, considering the theoretical frameworks to better define what is intended to be studied.

We have approached consciousness from a number of viewpoints such as philosophy, neuroscience and language. Prospective studies with interdisciplinary teams are required to address an issue so interesting and complex as consciousness.

Statement of Conflict of Interest

All the authors of this paper state they have no conflict of interest in this work.

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