Concept Article

The relation between language and pseudoscientific practices

A relação entre linguagem e práticas pseudocientíficas

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ABSTRACT | INTRODUCTION: Discourse Analysis has shown that neutrality is nonexistent in language. Each lexical choice is not random, and within each choice, there are diverse possibilities of intentions, collocations, and interpretations. Culture, habits, beliefs, and the set of characteristics that compose society influence language construction. In a society where science and scientific methods are underestimated or ignored while pseudoscientific practices are valued, it is expected that there will be a reflection of this in language. **OBJECTIVE:** To discuss the impact of language and lexical choices on the appearance of scientific legitimacy of pseudoscientific practices. **METHODOLOGY:** In this study, we use linguistic tools associated with scientific thinking to identify how pseudosciences can benefit from language to increase their credibility, focusing on the use of affixes. **RESULTS:** Language speakers have intuitions about formative rules and meanings related to affixes, even without formally studying linguistic constructions or epistemology. In this sense, pseudoscientific practices can benefit from the appearance of scientific legitimacy conferred by the popular etymological perception of suffixes and prefixes commonly used to designate areas or subareas of academic scientific studies. **CONCLUSION:** Words and affixes used in scientific language do not have precise and unequivocal definitions but are subject to varied and conflicting interpretations. Given this vulnerability, language, as a reflection of society we are part of, can limit our capacity for rational decision-making regarding health.

KEYWORDS: Pseudosciences. Discourse Analysis. Language.

RESUMO | INTRODUÇÃO: A Análise do Discurso tem demonstrado que a neutralidade é algo inexistente na língua. Cada escolha lexical não é aleatória e, dentro de cada escolha, há uma diversidade de possibilidades de intenções, colocações e interpretações. Cultura, hábitos, crenças e todo o conjunto de características que compõe uma sociedade influenciam a construção da língua. Em uma sociedade na qual a ciência e o método científico estejam sendo subestimados ou ignorados, enquanto práticas pseudocientíficas são valorizadas, é esperado que haja um reflexo disso na linguagem. **OBJETIVO:** Discutir o impacto da linguagem e das escolhas lexicais na aparência de legitimidade científica de práticas pseudocientíficas. **METODOLOGIA:** Neste estudo, utilizamos ferramentas da linguística associadas ao pensamento científico para identificar de que forma as pseudociências podem se beneficiar da linguagem para aumentar sua credibilidade, com foco no uso de afixos. **RESULTADOS:** Falantes de uma língua possuem intuições sobre as regras formativas e significados relacionados aos afixos, mesmo sem estudarem formalmente as construções linguísticas ou epistemologia. Nesse sentido, práticas pseudocientíficas podem se beneficiar da aparência de legitimidade científica conferida pela percepção etimológica popular de sufixos e prefixos comumente empregados para designar áreas ou subáreas de estudos acadêmico-científicos. **CONCLUSÃO:** As palavras e afixos utilizados na linguagem científica não possuem definições precisas e inequívocas, mas sim, estão sujeitos a interpretações variadas e conflitantes. Diante dessa vulnerabilidade, a linguagem, como reflexo da sociedade em que estamos inseridos, pode limitar nossa capacidade de tomada de decisões racionais em relação à saúde.

PALAVRAS-CHAVE: Pseudociências. Análise do Discurso. Linguagem.

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Introduction

Discourse Analysis has shown that neutrality does not exist in language. According to Pêcheux[1], "there is no discourse without a subject, and there is no subject without ideology." This position has been supported by other linguists and philosophers. According to Ferdinand de Saussure, language is an arbitrary and conventional system of signs, meaning that there is no natural relationship between a word and what it represents. This arbitrary characteristic of language allows for the manipulation of word meanings.[2] Jürgen Habermas, in his theory of communicative action, emphasizes the importance of language as a communication tool but notes that communication is not neutral because it always involves specific interests and objectives. Therefore, language is considered a form of social action that is closely linked to processes of power and domination.[3] Each lexical choice is not random, and within each choice, there are diverse possibilities of intentions, placements, and interpretations. Language, in essence, is not as objective and transparent as it may seem.[4]

Language, as a symbolic system, is not limited to its literal meaning as its sense is socially constructed and can vary according to context and social conventions.[5,6] For example, the word "terra" (word for land in Portuguese) has a different meaning for an indigenous person, a small farmer, and a large landowner, and its meaning changes if it starts with a capital letter (referring to the planet Earth) or a lowercase letter (referring to soil). Additionally, understanding a linguistic expression involves aspects beyond words, such as grammar and syntax, in a complex system of meanings.[2] From this perspective, Discourse Analysis seeks to reflect on texts and speech to understand them in a less naive and more rational way as culturally constructed social practices.[7]

The interpretation of language therefore transcends mere literal understanding of words, as "saying is not a private property. Words are not just ours. They mean through history and language".[4] The meaning of discourse is deeply shaped by the social context in which it is produced and received. In this sense, it is crucial to consider the context of language production, including the social, political, and ideological positions of sender and receiver.[8,9] Like the scientific method, which seeks to reduce uncertainty more than finding absolute answers, discourse analysis is not a purely objective process, but should be conducted with the least possible subjectivity, given that it is social research. In this sense, it is essential that discourse analysis be committed to the search for a more precise and complete understanding of discourse meaning based on empirical and theoretical evidence.[10]

In 1973, Levi-Strauss's anthropological study demonstrated that the opposition between the terms "sun" and "moon," marked by masculine and feminine gender, respectively, was related to the myths and beliefs of American peoples, who associated preconceived ideas of what was masculine and feminine with the stars. However, it was noted that other languages and cultures either did not differentiate "sun" and "moon," or did not use the same gender marking. In this sense, understanding the culture in question, including the habits, customs, beliefs, and way of life of the population in general, is crucial for analyzing the lexical choices of each language.[11]

From these studies, the theory of linguistic relativity and the Sapir-Whorf hypothesis emerged, proposing that language influences how speakers think and perceive the world, and vice-versa.[12,13] These concepts were crucial to understanding the relationship between language and culture. However, this relationship cannot be reduced to simple causality, as language does not seem to be exclusively determined by culture, but rather the result of a complex process involving biological, cognitive, and cultural factors.[14] In this context, language does not determine but influences individuals' perceptions of the world.[15] Similarly, although language does not represent all culture, it is an important indicator that is influenced by it. Therefore, the relationship between language and culture is multifaceted and bidirectional and requires a comprehensive and interdisciplinary approach.[16]

If culture, habits, way of life, beliefs, and all the set of characteristics that make up a society influence the construction of that people's language, in a society where science and the scientific method are being underestimated or ignored, while pseudoscientific practices are valued, it is expected that there will be a reflection of this in the language. As language is constantly evolving and modified by its speakers, arguments, terms, jargon, as well as suffixes and prefixes, may gain new meanings, adding or modifying the original sense.

Pseudoscientific Practices and Language

The demarcation between science and other areas of knowledge is a central issue in science philosophy. However, this demarcation is not as clear as one might imagine since science is also a social construction subject to interests and conflicts. Science is not a homogeneous entity but a field in constant motion, in which different actors compete for power and influence.[17] However, this does not invalidate scientific knowledge but rather reinforces the need for refinement and improvement of scientific theories and methods. In this sense, skepticism regarding information that is considered scientific is healthy, as it allows for questioning and revisions that can lead to significant advances. However, it is important to distinguish legitimate skepticism from unfounded denial of scientific evidence-based solely on economic, political, or ideological interests. This phenomenon has manifested itself in various areas, such as discussions on vaccination, climate change, and evolution.[18,19] In the face of the vast amount of information available, much of which is false or imprecise from a scientific standpoint, the pragmatic decision-making process in science-aligned information becomes complex.[20]

In simplified terms, we can understand pseudoscientific practices as practices that present themselves as scientific but whose knowledge and techniques are not derived from systematic, transparent investigation based on empirical evidence. In other words, pseudoscience departs from the organized skepticism characteristic of science, which aims to constantly question and test scientific hypotheses and theories to avoid confirmation bias, the acceptance of ideas without sufficient evidence, and the use of fallacious arguments to support theories.[21-23]

The use of language is a strategy that helps confer a veneer of credibility to pseudoscientific practices, which often use logical fallacies, emotional arguments, appeals to authority, and specific lexical choices to convey a false sense of credibility.[24] For example, suffixes and prefixes that are commonly used to designate areas or sub-areas of academic-scientific studies can be observed in terms such as Iridology, Anthroposophy, and Neuro Feng Shui, which have little or nothing to do with the ideas conventionally associated with the suffixes -logy and -sophy or the prefix neuro-.

The distorted use of such affixes is not surprising. Those who create, replicate, and implement linguistic forms are language users themselves.[25,26] In this scenario, "each natural language represents an open system and, therefore, is open to be changed by the speakers." Thus, linguistic changes do not necessarily adhere to a formal logical sense or align with scientific methods.[27]

Although most language changes occur organically, it is important to be aware that the relationship between language and ideology is solid and relevant to understanding the influence of language on the expression and perpetuation of an ideology. Mikail Bakhtin asserts that everything ideological has a meaning that refers to something external, becoming a sign, indicating the close connection between language and ideology. The choice of words, structures, and contexts used in communication can reflect the speaker's beliefs and ideological positions.[28] Language is a tool for transmitting ideas and values, and its use can be consistent with a particular worldview that is not necessarily aligned with scientific logic. Understanding this relationship between language and ideology is essential to critically evaluate the ideas presented to us and understand the messages conveyed through language.[29]

The use of prefixes and suffixes in pseudoscientific practices

Structuralism, a linguistic movement that emerged in the late 19th and early 20th centuries, argues that every word is segmentable into its constituents. This analysis makes it possible to understand the formation of new words through the addition of prefixes and suffixes as well as allowing speakers of a language to have intuitions about the formative rules related to affixes, even without formally studying the language or its linguistic constructions. Suffixes and prefixes can contribute to so-called polysemy, that is, the existence of multiple meanings for the same word.[30,31] This phenomenon is more common in flexible words or those with broader meanings, and can be influenced by the subject's cultural and cognitive background.

It is important to note that the initial meaning of a word can be considerably distant from its current meaning, such as the Portuguese suffix -inho, which indicates

diminutiveness, but in Latin, -inus was a suffix used to form adjectives without the idea of diminution. This highlights that when breaking down a word with a suffix, the initial term can be semantically distant from suffix.[32] However, some terms, particularly technical terms, are created to represent specific concepts and are not prone to acquiring new meanings. These notions are important not only for understanding language, but also for understanding how language is used in pseudoscientific practices, which often employ neologisms formed by adding affixes to create an appearance of scientific legitimacy.

For example, the Greek suffix -logy, which originally meant narrative, logical, or rational discourse through historical and cultural processes, is now predominantly used to refer to a systematic study or theory of a particular area of scientific knowledge, such as Biology, Psychology, Sociology, Cardiology, Neurology, Hematology. However, its use has also been employed in neologisms to describe pseudoscientific practices, such as Ufology, Parapsychology, Numerology, Cryptozoology, Astrology, Iridology, among others.

The suffix -logy is insufficient to define the epistemological nature of an area of study. An area is considered scientific not because it exhibits this suffix but because it uses systematic and transparent methods and seeks to explain phenomena based on theories that are, as far as possible, empirically tested. However, as discussed earlier, speakers of a language have intuition about the formative rules and meanings related to affixes, even without formally studying linguistic or epistemological constructions. In this sense, pseudoscientific practices can benefit from the appearance of scientific legitimacy conferred by the popular etymological perception of suffix -logy.

Of all these terms, perhaps the oldest and most widespread is "Astrology." Initially, Astrology referred to the study of the relationship between the movement of stars and their influence on crops and people's lives, at a time when the same person who guided ships on the ocean by the position of the stars also claimed to predict the future. The demarcation between scientific knowledge and other knowledge was even less clear than today. On the other hand, astronomy, the science that enunciates the laws and theories that govern natural phenomena, and that has a closer relationship with the current understanding of the suffix -logy, only achieved the status of science in the seventeenth century, with well-defined methods and objects.[33] Considering etymological aspects, it could be hypothesized that after the division between Astrology and Astronomy, it would be possible to replace the suffixes employed. The Astrology we know today could be renamed astromancy, since the suffix -mancy derives from "manteia," from Greek, conferring the idea of prophecy, divination, and superstition (used in words such as Cartomancy, for example). The astronomy we know today could be called astrology. However, we would be faced with two main questions: 1) defenders of Astrology as a "scientific area" would not accept the suffix -mancy, which would make it clearer that the concept of signs governing our lives and personalities reduces to superstition, and 2) changes in language cannot be arbitrary, under the risk of not being effectively incorporated by its users. In this case, it is important to note that the choice of suffix was not arbitrary, reflecting historical, cultural, and epistemological aspects related to the observation of the stars.

On the other hand, there are more arbitrary uses of affixes, as in the case of Neuro Feng Shui, which employs the prefix "neuro-" found in terms such as Neurology and Neuroscience. These refer to the study of the nervous system and its functions, and the medical specialty that provides diagnosis and treatment for diseases that affect the nervous system. Feng Shui, in turn, is a belief of Chinese origin that claims, without scientific evidence, that the distribution of furniture and objects in the house can harmonize "energetic forces," which can impact an individual's mental health. The creation of the term Neuro Feng Shui constitutes an arbitrary attempt to attribute scientific epistemological validity in the field of neuroscience to a pseudoscientific practice.

In addition to the use of the prefix "neuro-," other practices use the suffix "-therapy," giving the appearance of therapeutic efficacy in the absence of scientific demonstration of such efficacy. This is the case with Magnetotherapy, Crystalotherapy, Ozonotherapy, and other methods that use the same structuralist logic, such as homeopathy. Finally, the deviation of terms derived from physics and chemistry to confer authority on areas of health without adequate evidence is also common, as seen in treatments referred to as "quantum" or "orthomolecular."

Final Considerations

The analysis presented in this article demonstrates that the words and affixes used in scientific language do not have precise and unequivocal definitions; rather, they are subject to varied and conflicting interpretations. It is therefore noteworthy that language is not just a means of communication, but also a fundamental tool in the construction and negotiation of values and meanings in a society.

Considering the fragility of the social fabric in the face of pseudoscientific practices and the limited understanding of science and the scientific method, it is possible to observe that this situation is reflected in language. Given this vulnerability, language, as a reflection of the society in which we are embedded, can limit our ability to make rational health decisions. It becomes evident, therefore, that pseudoscientific practices have a fertile ground to proliferate, gaining prominence and credibility in our language, which, in turn, can undermine the understanding and appreciation of scientific knowledge.

Authors' contributions

Bacchi BS contributed with the writing of the theoretical linguistic aspects of the article, while Bacchi A contributed with the theoretical aspects related to Science and Pseudoscience. The two authors participated in the writing, revision and approval of the final version of the article.

Conflicts of interest

No financial, legal, or political conflicts involving third parties (government, private companies, and foundations, etc.) were declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

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