

The Embodied Theory of Language: Evidence and Constrains

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ABSTRACT. In the last decade, the notion of “embodiment” has increased its importance in the field of cognitive (neuro)science. According to the embodied view of cognition, there is no separation between “low” level cognitive processes (action and perception), and “high” level cognitive abilities (abstract thought and language comprehension). The theory of embodied language has recently begun to challenge the traditional mainstream in cognitive linguistics, stating that our conceptual system is largely *constrained* by the kind of body we possess and by our sensorimotor expertise.

My argument proceeds through three steps. First of all, I will introduce the main tenets of Lakoff and Johnson’s view of language. This is what I consider the most influential example of *radical* theory of embodied language. Next, I will review some recent acquisitions from behavioral and neuroimaging studies, showing that a radical theory of embodied language is in part, but not completely, supported by established empirical findings. Finally, I will focus on Lakoff and Johnson’s theory of metaphorical extension, and I will argue that this proposal suffers from critical problems due to the presence of an important constraint on simulation.

KEYWORDS: Cognitive Linguistics, Embodiment, Action Understanding.

1. The Radical Meaning of Embodiment

A traditional belief in the philosophy of language is that meaning can be conceived as an abstract entity divorced from bodily experience, and that understanding language consists in the translation of external physical information (e.g. sounds) into an internal medium (the “language of thought”). This view of language considers meaning in terms of abstract symbols, so that understanding language requires nothing but the ability to manipulate a-modal mental representations.

Over the last few decades, an alternative view of language has begun to acquire increasing consensus among the community of philosophers and cognitive linguists. According to this view, human communicative ability arises from the nature of our bodies, so that language cognition cannot be divorced from bodily shape. A radical theory of embodied language (RTEL) leads to the assumption that language processing is *functionally* based on the sensorimotor system, and that any instance of linguistic communication grounds its meaning in the subject’s bodily experience. The most influential example of RTEL is represented by Lakoff and Johnson’s concept whereby the nature of our bodies shapes our ability to conceptualize, so that the entire conceptual system has an embodied foundation and makes sense only for embodied subjects (Lakoff & Johnson, 1999).

Accordingly, there are two ways to understand the embodiment of a conceptual system. On the one hand, conceptual structures can be simply conceived as neural configurations, making embodiment only a trivial notion, in that nobody denies that a cognitive function must be related to a certain state of the brain. On the other hand, the conceptual system can be conceived as a neural network that makes use of the sensorimotor system of the brain, so that our concepts are functionally shaped by our sensorimotor capabilities. Lakoff and Johnson’s RTEL states that the same neural and cognitive mechanisms that allow us to perceive and move around also contribute to the creation of our conceptual system, so that understanding linguistic communication means retrieving visual and motor information exploiting the properties of the sensorimotor apparatus (Lakoff & Johnson, 1999, p. 4). The critical point is that Lakoff and Johnson’s RTEL rejects the absolute distinction between the motor and the conceptual systems, assuming that the sensorimotor apparatus imposes a structure of its own on the formation of the entire conceptual system, from concrete to abstract domains.

According to this view, RTEL is a testable hypothesis, and the question of whether language is actually embodied must be settled in experimental neuroscience, not just in the domain of philosophical speculation.

2. Experimental Evidence

The hypothesis that the processing of concepts is accompanied by the activation of modality-specific brain areas is supported by a number of studies (for a review, see Fischer and Zwaan, 2008). An embodied theory of language finds confirmation in various imaging studies clearly showing that the processing of *action-related words* has a correlate in the activation of areas in the pre-motor and motor cortex (Pulvermüller et al., 2009). More accurate studies show that words referring to actions performed with specific effectors (such as “to lick”, “to pick”, and “to kick”) activate the motor system in a somatotopic manner (Hauk et al., 2004). Experimental results show also that the amount of kinematic information conveyed by an action verb produces changes in the hemodynamic response of participants, while reading verbs that denote very general actions (e.g., to clean), contrasted with the response to words denoting actions associated with specific motor programs (e.g., to wipe) (van Dam et al., 2010). In addition, as demonstrated by Beilock et al. (2008), motor activation during language processing is found to be related to one's personal motor expertise.

In order to rule out the hypothesis that motor activations are the consequences of imagination processes, Pulvermüller et al. (2005) specified the time point of cortical activations, showing that word-specific activations in the motor system arise early, within 200 msec of stimuli presentation, while Boulenger et al. (2006) showed that motor activations are associated with action-related linguistic stimuli, even if they are too fast to trigger any mental imagery activity.

A crucial test of the functional role of motor regions in language comprehension comes from studies conducted on subjects with selective deficits in the motor regions. Accordingly, Bak et al. (2001) showed that action verb production and comprehension are both selectively vulnerable in association with bilateral motor system impairment. Boulenger et al. (2008) examined the impact of Parkinson's disease on lexical decisions, showing that the processing of action words can be selectively disrupted following a pathology that affects the motor system. Recently, Averalo et al. (2011) have shown that lesions due to stroke in key sensorimotor regions usually considered part of

the mirror neuron network impact patients' accuracy in matching pictures and words associated with body parts.

All in all, these studies support the assumption that language processing recruits modality specific brain areas *at least* when action-related concepts are involved in communication, and that in these cases the occurrence of simulation processes in the sensorimotor system performs a functional role. This conclusion supports RETL only in part, leaving open the question of whether an embodied theory of language can be extended to abstract concepts.

3. Simulation Constraints

If the comprehension of language requires the re-enactment of our sensorimotor experience, how do we understand language that is unrelated to the concrete sensorimotor domain, such as abstract words and sentences? Lakoff and Johnson have proposed that the entire conceptual system is grounded in the sensorimotor domain, and that this is made possible by a metaphorical process that permeates our linguistic processing. According to Lakoff and Johnson, a metaphor is a neural mechanism that naturally recruits the sensorimotor system for use in abstract thought. Abstract meanings arise from concepts that are directly grounded in the sensorimotor system via a metaphorical lifting that makes it possible to exploit the same structure in different contexts. In order to describe the structure common to the sensorimotor and the abstract conceptual domains, Lakoff and Johnson refer to topological schemas called image schemas (Lakoff and Johnson, 1999). These structures play a causal role in bringing about an understanding, imposing special relations that ground language processing in the subject's experience of the environment. Accordingly, abstract words and sentences are assumed as metaphorical extensions of the concrete language in which understanding is directly grounded in the sensorimotor domain. The passage from a concrete to an abstract context, it is argued, is guaranteed by the exploitation of topological cognitive schemas that ultimately define the internal structure of the metaphorical process.

Notwithstanding its popularity, this view suffers from two main difficulties due to the presence of a number of critical constraints on the occurrence of sensorimotor simulation processes. First of all, the reference to topological schemas doesn't does not explain by itself the functional involvement of the motor system in language understanding as required by RETL. Even assuming that the internal structure of our concepts is an instantiation of topological

schemas (Peruzzi, 2000), there is no evidence that our sensorimotor system is sensitive to static relations, as represented by many image schemas. Accordingly, Lakoff and Johnson's theory of topological structures is not adequate for predicting and explaining the involvement of the sensorimotor apparatus in the processing of abstract concepts.

Secondly, we know that a motor resonance is not a byproduct that follows the recognition of kinematic or topological patterns, but is strictly connected with understanding the *goal-relatedness* of an action (Umiltà, et al., 2008). Accordingly, if the involvement of the motor system in language processing is related to the understanding of motor intentions (Borghi et al., 2012), it is not clear how Lakoff and Johnson's topological structures might represent a vehicle for extending motor intentionality from the concrete domain of actions to the abstract context. Indeed image schemas only describe topological relations among referents and say nothing about goals and action possibilities in the environment.

4. Conclusion

Lakoff and Johnson's RETL, according to which the entire conceptual system is grounded in the functioning of the sensorimotor system, is only *partially* supported by empirical evidence. Experiments show that the understanding of action-related words and sentences is grounded in the activation of the motor and pre-motor system, but say nothing about the linguistic processing of contexts that lack of a direct motor salience. Even if a great deal of experimental work remains to be done, Lakoff and Johnson's theory of metaphorical extension seems unable to predict and explain how the understanding of abstract words and sentences may be thought to be grounded in the sensorimotor apparatus. A simple analysis reveals that the theory of topological cognitive schemas does not fit adequately with some constraints on simulation, as it ignores the fact that a sensorimotor resonance is a cognitive mechanism for goal recognition and action understanding.

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