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Metaphor and Science

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In the past thirty years, philosophers of science, philosophers of language, and cognitive scientists have emphasized the importance of understanding metaphor, although they rarely agree on the role it plays in thought. One dominant theory of metaphor treats metaphor as abbreviated simile. However, this theory does not acknowledge the embodied nature of metaphor, nor does it acknowledge that a metaphor has individual and influential meanings beyond the literal meanings of its constituents. In this essay, we explore this critique and discuss its relevance for understanding new concept formation.

Regardless of position, there are a few features of metaphor that theorists agree on. First, metaphors play a deviant role in language: “In the utterance of a fresh metaphor the speaker explicitly violates the conventional expectations of the community.”1 The words or phrases used in a metaphor are employed outside of their literal use. Secondly, metaphors are about “applying information and understandings from one domain of experience, which we call the source domain, to enhance understanding of another domain called the target domain, that is typically more abstract.”2 Whether or not meaning is transferred across domains is a point of contention in theories of metaphor. In the following sections, we will argue that a shift in meaning is a more plausible theory, given the apparent role of metaphor in science.

Metaphors are used widely in science to facilitate both communication and conceptual understanding amongst scientists and to the non-scientific public. From ancient models of the atom, to the concept of protein folding and global warming, scientists rely on complex metaphors to further their research and understanding.3 Metaphors are not used merely for convenience, but out of necessity. It is important to acknowledge the significant role of metaphor in scientific thought because of the impact it has on thought in general. There are cases in which scientists can only express new concepts, even to themselves, by way of metaphor. For example, when William Harvey proposed a solution to the mystery of how such a high volume of blood was pumped by the heart, he compared (what we now know as) the circulatory system to a circle.4 That is, the metaphor of blood circulation as a circle helped clarify and modify important concepts in physiology, and directly contributed to the process of developing a coherent explanatory concept (the term “circulatory system” is now ubiquitous). This shows that the meanings of metaphors are understood apart from the literal meanings of any of the words in them. The circulatory system is not literally a circle and a system; the metaphor conveys more than this. The metaphor is useful precisely because it does not simply refer to the exact meaning of the literal words. Instead, by highlighting possible relevant aspects of the source domain, it introduces a new way of understanding the target domain, which otherwise would have remained obscure. This is directly contrary to the positivist idea that “all scientific descriptions are purely literal” and concurs with the idea of a general degradation of the distinction between literal and metaphorical meaning.5 As shown in the example, by altering existing concepts and adding depth of meaning to new concepts, metaphors can...
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can introduce deviations in meaning—and these generally at a particular time—but cannot instantly alter the literal meaning of a word for the larger community. When the phrase “blood vessels are irrigation canals for the body” is uttered to unsuspecting members of the community, the literal meaning of blood vessels still does not include the notion of “passage of fluid.” Thus the similarity is not yet embodied in (literal) meaning (as required by abbreviated simile), and yet the metaphor holds. The metaphor is still expressive of some meaning beyond the known similarities. For a perhaps clearer example: William Harvey raised the following problem: How could the heart pump out more blood in the space of one hour than the weight of a person? Only through the metaphor of the blood’s movement in terms of a circle could Harvey explain how the blood went through the body at such a high rate. This hypothesis of continual circulation required a significant reformulation of the concept of movement of blood. This metaphor of “circular movement” to “movement of blood” was applicable and meaningful in a way that cannot be captured by simile, because the relevant similarities that the simile purports to expose are not known or understood. The meaning of a metaphor must be derived from somewhere else. Properties seem to be transferred, in a semantic sense, from the source domain (ex. irrigation canals) to the target domain (ex. blood vessels).

To discuss an alternate theory, as opposed to metaphor taken to be an abbreviated simile, in this theory a metaphor genuinely has meaning beyond the literal meanings of its constituents; it does more than highlight similarities within the concepts. A metaphor’s meaning is an amalgam of the two or more words or ideas present in the statement. This meaning alteration can go both ways, with words or ideas present in the statement. This means relevant aspects of each domain are highlighted, while other aspects are left out. As a result, those who see the metaphor will be influenced by it—they see through the lens of the metaphor, so to say. The metaphor takes on a certain power to dictate conceptual understanding. Instead of bringing out similarities in ideas, a metaphor applies aspects of the semantics of one idea (generally the source domain) to the semantics of the other idea (generally the target domain) by either addition or replacement. Thus the target domain is now characterized by semantic elements it is usually not characterized by, and the fruitfulness of such an alteration (determined by interacting with the object [referent] of the target domain) will determine the power of the metaphor. For example, when aspects of “circular movement” were added to “movement of blood,” that alteration in “movement of blood” proved to have great fruitfulness in explanatory and problem-solving situations. And so, metaphors begin to move from their source domain of the metaphor comes from the body’s sensorimotor system. Finally, the correlation is instantiated in the body via neural connections. Understanding that metaphor as essentially linked to our embodied experience opens up the potential for new classes of metaphors. As we encounter

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It is important to acknowledge the significant role of metaphor in scientific thought because of the impact it has on thought in general. We cannot build up to abstract thought without primary metaphors. An important implication of the primary metaphor theory is that it demonstrates metaphor is embodied in three ways. In metaphor, the “correlation arises out of our embodied functioning in the world . . . Second, the new sensorimotor or subjective experiences or judgments, we can create new primary metaphors, which could lead to the creation of new concepts and ideas and then to new stages of a language. This cannot happen if we accept the simple theory of metaphor because it does not allow for new meaning creation through metaphor.

Conclusion

In accepting the position of metaphors as capable of modifying meaning, we have demonstrated that metaphors are not secondary to literal meaning; they are distinct from literal meanings of words. Metaphors can act on the involved domains in order to alter and refine established concepts and potentially generate new concepts. This linking and altering of concepts, in conjunction with the theory of primary metaphors, suggests that metaphor is an early and primary component of new concept formation. When individuals are trying to express something new (whether it be in science or poetry), metaphor lends itself to this endeavor because it can forge links between things that did not previously exist. The expressive power of metaphor runs deep. It is how individuals utter what they feel yet cannot say. It is at once an expression of links beyond words and also the first step to introducing new elements into linguistic life.