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Types of metaphors and mechanisms of comprehension

Hassan Banaruee[1]*, Hooshang Khoshsima[1], Esmail Zare-Behtash[1] and Nahid Yarahmadzehi[1]

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*Corresponding author: Hassan Banaruee Dept. of Language and Literature, Chabahar Maritime University, Chabahar, Iran
E-mail: Hassan.banaruee@gmail.com

Reviewing editor:
Lawrence Jun Zhang, Curriculum and Pedagogy, University of Auckland Faculty of Education and Social Work, New Zealand

Additional information is available at the end of the article

Abstract: Describing the processes of metaphor comprehension has been a hot topic of discussion among researchers throughout the past four decades. One of the major challenges has been to find a mechanism that can describe the processes involved in the comprehension of various kinds of metaphors. This article suggests that different types of metaphors could be understood through rather different mechanisms. To demonstrate this point, two different groups of metaphors are discussed. The first group includes those metaphors that are used to describe highly abstract concepts. In many cases, these abstract concepts are understood in terms of motion or non-motion events in the three-dimensional space. The second group includes those metaphors which are used to describe concepts with a higher degree of concreteness. In many cases, these metaphors are understood by attributing a salient feature of a metaphorical category to the topic of the metaphor. Because of their nature, the first group of metaphors can be understood in terms of a set of elements in a three-dimensional space. This can be done by the mapping of relations in the source domain into relations in the target domain. Therefore, this group of metaphors is understood through a more complex type of processing. However, degree of complexity of metaphor processing could be dependent on a range of factors, including the number of elements that are involved in the source and target

Hassan Banaruee

ABOUT THE AUTHOR

Dr. Hassan Banaruee is presently doing his PhD at Chabahar Maritime University. He is the founder and owner of *Bartar Language Academy*. His major fields of interest are Psycholinguistics of metaphor, English Language Teaching through using cognitive and neuroscience findings. He has published 27 scientific articles in indexed journals, and 4 books and has presented his research at national and international conferences. He currently researches the context-metaphor comprehension, cognitive linguistics and cognitive psychology issues involved in language teaching.

PUBLIC INTEREST STATEMENT

Metaphors are so pervasive in every aspect of our language that it is almost impossible to communicate effectively without using metaphors, they make language colorful and attractive. This is highly important to understand what are the processes of comprehending metaphors. This article discusses several categories of concepts that are described by metaphors or are used to metaphorically describe other concepts in two groups. The first group includes those metaphors that are used to describe concepts which have a high degree of abstractness. In many cases, these concepts can metaphorically be described and understood in terms of motion or non-motion events in the three-dimensional space. The second group of metaphors is those which are understood by including topic of metaphor into a metaphorical category defined by one or at most several salient semantic features. It is concluded that different mechanisms might be employed to process different kinds of metaphors.

domain, the nature of relations among elements in the source and target domains, degree of abstractness of the concept that is described by the metaphor, and semantic features of source and target domains.

Subjects: Cognitive Psychology; Cognitive Neuroscience of Language; Psycholinguistics

Keywords: metaphor comprehension; abstract concepts; three-dimensional space; mapping; motion events

1. Introduction

The prevalence of metaphors in our daily language has been the subject of a large body of research in recent decades. The rising interest in metaphor studies accelerated after the publication of Lakoff and Johnson's *Metaphor we live by* (Lakoff & Johnson, 2003). Metaphors are so pervasive in every aspect of our language that it is almost impossible to communicate effectively without using metaphors. Some recent studies have investigated the use of metaphoric language in editorial cartoons (Lan & Zuo, 2016), online consultations (Thonus & Hewett, 2016), newspaper (Fallah & Moini, 2016), political speeches (Bakhtiar, 2016), and religious discussions (Richardson, 2017). A fundamental question that might be raised is that why metaphors are extensively used in our language. This question might be answered differently from various perspectives. From a literary perspective, it might be said that metaphors are used to make language more beautiful. Metaphor is a literary device that is used to make language colorful and attractive. Therefore, from a literary perspective, metaphors are used to make a profound impact on the target audience and to get them involved in the content of the message. From a psycholinguistic perspective, the answer would probably be very different. One possible answer is the power of metaphors to communicate effectively. However, this answer is very general. This article tries to answer this question more specifically by discussing several categories of concepts that are described by metaphors or are used to metaphorically describe other concepts. Because of their nature, abstract concepts are extensively described by metaphors. Before discussing metaphoric description of abstract concepts, their nature and characteristics are discussed in the following section.

2. Abstract and concrete concepts

The difference between abstract and concrete concepts and the mechanisms through which these concepts are processed in our mind have been one of the most-discussed subjects in the literature of cognitive science. Abstract concepts cannot be pinned down to easily identifiable referents (Borghi et al., 2017). In fact, they do not have bounded or clearly identifiable referents that can be perceived through our senses. The abstract concept of "sympathy" does not have a clearly identifiable or perceivable referent. Compared to concrete concepts, abstract concepts are more detached by our sensorial experience (Fernandino, Humphries, Seidenberg, Gross, Conant, & Binder, 2015). Therefore, while concrete concepts can directly be perceived through the channel of our sensorial system, abstract concepts need some kind of mediatory tool to be understood. One of these tools is metaphor. According to Lakoff and Johnson (2003), the essence of metaphor is understanding one thing in terms of another thing. Although abstract concepts cannot be directly perceived through our sensorial system, they can be described in terms of concrete concepts that have clearly identifiable referent and that are perceivable through our sensorial system. In other words, a concrete concept can function as a mediatory tool through which a concretely unidentifiable concept can be perceived and understood through sensorial system. The process of understanding an abstract domain in terms of a concrete domain can be seen as a kind of representational transformation (Khatin-Zadeh, Khoshsima, & Banaruee, 2017) in which an abstract domain is described, represented, and comprehended by a concrete domain. In the process of representational transformation, there is no need for the existence of any similarity between the two domains. One domain can be represented in terms of another domain while the two domains may be completely dissimilar in terms of concrete and non-concrete features.

3. Using motion events to metaphorically describe abstract concepts

Motion events are the ubiquitous feature of our daily lives. Almost every corner of our lives includes some kind of motion activity. Every motion event consists of a number of elements; an object (figure) starts its movement from a source point and ends at a goal point. This movement is made along a certain path. Manner of movement and the ground, with respect to which movement is described, are the other elements of any motion event. The ways that motion events are encoded in various languages have attracted a lot of attention throughout the past four decades. Talmy (1975, 1985, 1991, 2000) presented his model of cross-linguistic differences in describing motion events to find how elements of motion events are linguistically encoded and how various languages can be included in the categories of this model. According to Talmy's typological model, languages fall into two categories: satellite-framed (S-framed) and verb-framed languages (V-framed). Satellite is the grammatical category of any constituent other than a noun phrase or prepositional phrase complement that is in a sister relation to the verb root (Talmy, 2000, p. 113). English verb particles and German verb prefixes are examples of satellites. S-framed languages encode manner in the verb and path in a satellite to the verb; on the other hand, V-framed languages encode path in the verb and manner in a satellite or an adjunct clause (Talmy, 2000).

Because of their nature, motion events are widely used to describe abstract concepts. Three reasons have been suggested to be behind the widespread use of motion events to metaphorically describe abstract concepts: high degree of concreteness of motion events, high degree of imageability, and the simultaneous imageability of their components in a three-dimensional space (Khatin-Zadeh., Banaruee, Khoshsima, & Marmolejo-Ramos, 2017). Three-dimensional space is a geometrical setting in which the place of every object is determined by three values and relative to a reference point. For example, the English metaphor *He hit the roof* describes the abstract concept of "angriness" in terms of a rapid upward movement. In fact, an internal abstract state is understood as a motion event that includes several concrete components. Among the three features that were mentioned, the feature of space is perhaps particularly important. There are many metaphors that describe concepts in terms of a domain in the three-dimensional space. For example, the abstract concepts of "good" and "bad" are described in terms of right and left in the three-dimensional space (De la Fuente, Casasanto, Martínez-Cascales, & Santiago, 2016) and the abstract concept of "power" is described in terms of vertical dimension (Lakens, Semin, & Foroni, 2011).

The embodied theories of cognition suggest that the neural networks that are involved in acting with objects and events are also involved to internally simulate those objects and events (Barsalou, 2008; Kan, Barsalou, Solomon, Minor, & Thompson-Schill, 2003; Yee, Chrysikou, Hoffman, & Thompson-Schill, 2013). Gallese and Lakoff (2005) argue that when we imagine doing an action, some of the same part of brain is used as when we actually do that action. They add that the same neural substrate involved in doing an action is used in imagining and understanding that action. This theory has been extended by Lakoff and Johnson (1999) to include metaphors. They have argued that understanding the metaphorical phrase *Grasp an explanation* would involve motor representations that are related to actual doing of grasping. In other words, even the metaphorical description of an abstract concept in terms of a physical action or motion event involves the same neural network that is involved in that physical action or motion event. Similar ideas have been discussed by a number of researchers (for example, Barsalou, 1999; Damasio, 1989; Damasio & Tranel, 1993; Feldman & Narayanan, 2004).

Using a metaphor whose base is a manner of movement (for example, *Run for the office*) might activate the motor or the visual motion system (Gallese & Lakoff, 2005; Gibbs, Costa Lima, & Francozo, 2004). To take another example, the abstract concept of "time" is understood in terms of a more familiar domain of spatial movement (Jamrozik, McQuire, Cardillo, & Chatterjee, 2016). Spatial movement, real or imagined, has been found to affect our conceptualization of time (Boroditsky, 2000; Boroditsky & Ramscar, 2002). In fact, according to the direction of movement, the concept of time may be understood differently. Wilson and Gibbs (2007) found that

comprehenders were faster to make a decision on the meaningfulness of a sentence if they had performed (or imagined performing) a congruent movement just before reading a metaphor. For example, participants were faster to make a decision on the metaphorical phrase *grasp a concept* if they had performed the action of grasping before reading this metaphorical phrase.

The results of all these studies suggest that the understanding of metaphorical description of abstract concepts in terms of physical movements in the three-dimensional space involves those areas of brain that are employed to do the same physical movements. An important question that is raised here is about the reason of widespread use of metaphors. If we assume that metaphors help us to obtain a more profound understanding of our world, how can they do that? How symbolizing one concept in terms of another concept can help us to deepen our understanding of the former concept? The following sections will try to answer these questions.

4. Concreteness and imageability

As was mentioned, high degree of concreteness and imageability has been suggested to be critical for the suitability of motion events to describe non-motion and abstract concepts (Khatin-Zadeh. et al., 2017). Since bodily movement can be considered as a special type of motion events (they involve the movement of body parts, and sensory-motor system has a direct role in them), everything that is said about the suitability of general motion events can also be applied to bodily movements. In fact, bodily movements are a special category of motion events that are especially suitable for metaphorical description of abstract concepts, as they involve motor and sensorial systems. When an abstract concept is understood in terms of motion events, sensory-motor system becomes involved in the process of understanding. In fact, a concretely unidentifiable concept is represented by a concretely identifiable concept. This concretely identifiable concept is represented by a set of neural nodes in the neural networks. Here, a representational transformation occurs in which an abstract concept is transformed into or represented by a concretely identifiable motion event or bodily movement. Since this motion event or bodily movement is represented by a set of nodes in the neural networks and sensory-motor system, this metaphorical description can be considered as a kind of mediatory tool in which an abstract concept is transformed into a concrete concept and thus represented by neural nodes in the sensory-motor system. The change of representation is a cognitive process that could significantly facilitate the understanding of concepts (Khatin-Zadeh et al., 2017). This facilitation could be one of the reasons behind our tendency to use metaphors in our language. In fact, we employ various tools and strategies to deepen our understanding of the world. Language is one of the mediatory tools that help us to construct a better understanding of world's concepts, and metaphor is a specific linguistic tool that is employed to achieve this objective. In fact, in the metaphorical description of abstract concepts in terms of physical movements or motion events, a chain of representational transformation occurs. Initially, an abstract concept is represented or symbolized by a word of language. Then, this word is represented or symbolized by another word which itself represents a concretely identifiable physical movement or motion event. This physical movement or motion event is represented by a set of neural nodes in the sensory-motor system. In other words, in a metaphorical description of an abstract concept in terms of a motion event, a sequence of representational transformation or symbolization occurs. Although all stages of this chain of symbolization are not completely similar, all of them can be conceived as a process in which one thing is represented by another thing. The starting point of this representational transformation is an abstract concept detached from physical characteristics, and ending point is a concrete concept represented by neural activities in the sensory-motor system.

Imageability of some concepts could be another major reason behind the widespread use of metaphors. In fact, when a non-imageable concept is described in terms of an imageable concept, its understanding might significantly be facilitated. The feature of imageability is the focus of the Dual Coding Theory. According to this theory, concreteness is positively correlated with imageability (Paivio, 1986; Paivio, Yuille, & Madigan, 1968). This theory assumes that only concrete concepts have a direct connection with images. Since the sense of vision is the primary channel

through which motion events are perceived, such events have a high degree of concreteness. In fact, when an abstract concept is described in terms of a motion event, it is transformed into a visual mode. One of the main features of the visual mode of a concept is that it is easily analyzable. In other words, the components of the concept (concept as a system of components) can easily be distinguished from each other, and the positions of components relative to each other can easily be understood. This feature is perhaps one of the main reasons behind the easy understandability of visual representations of concepts. Since motion events have a high degree of imageability, the description of abstract concepts in terms of motion events facilitates the process of understanding that concept.

5. Easy access to typical members of metaphorical class

According to the class-inclusion model of metaphor comprehension, the metaphor *X is a Y* is understood through the direct inclusion of *X* in a class of entities exemplified by *Y* (Glucksberg & Keysar, 1990, 1993; Glucksberg, McGlone, & Manfredi, 1997). This theory assumes that the metaphor *My lawyer is a shark* is understood as a class-inclusion statement that puts *my lawyer* and *shark* into a common category whose members are vicious, aggressive, tenacious, etc. (Glucksberg & McGlone, 2001; Glucksberg & Keysar, 1990, 1993; Glucksberg et al., 1997; Gluckesberg, Newsome, & Goldvarg, 2001). It has been suggested that the vehicle of every metaphor (*Y*) has dual reference (Glucksbers, 2003). For example, the word *shark* might be used in two senses. In one sense, it refers to a creature that lives in the sea; in another sense, it refers to all creatures that are vicious, aggressive, and tenacious. In the metaphor *My lawyer is a shark*, the word *shark* refers to this latter category. In fact, *my lawyer* is included in a category of entities that are vicious.

Based on this proposal, Khatin-Zadeh and Vahdat (2015) have suggested that metaphorical class of a term is defined by one or at most several semantic features, while the literal class of the term is defined by a large set of semantic features. Each semantic feature refers to one aspect of a concept's meaning. They add that the metaphorical class includes a set of entities that share one or several salient semantic features. Each one of these entities could be used in the vehicle position of the metaphor *X is a Y* (*X* is the topic and *Y* is the vehicle). However, when the most typical member of the metaphorical class is placed in the vehicle position, the most acceptable form of the metaphor is produced (p. 357). In other words, by putting members of the metaphorical class in the vehicle position of the metaphor *X is a Y*, a set of metaphors are created, among which the most acceptable one is produced by putting the most typical member of the metaphorical class in the vehicle position. Since the most typical members are usually the most accessible members of any category, it might be said that describing topic of a metaphor (*X*) in terms of an easily accessible member of a metaphorical category would facilitate the process of understanding. That is, the concept of *X* could effectively be described in terms of a typical member of metaphorical class defined by one salient semantic feature. This is in agreement with Ortony's (1979) salience imbalance model, according to which the essence of a metaphor is to attribute a salient feature of vehicle to a topic that has the same feature with a less degree of saliency.

6. Types of metaphor and mechanisms of comprehension

In the previous sections, two mechanisms were discussed through which two different groups of metaphors could be understood. The first mechanism is used to describe concepts in terms of concretely perceivable motion events. This is a mechanism that is very useful to understand abstract concepts that cannot directly be perceived through our sensorial system. Sometimes, abstract concepts are described in terms of a motion event in the three-dimensional space; sometimes, they are described in terms of a motion-less schema in the space. In both cases, space plays a critical role in the process of description. In fact, through this type of mechanism, an abstract concept is described and represented by a domain in the three-dimensional space that can be perceived through the channel of visual sense. This mechanism is very useful to describe highly abstract concepts that are very difficult to understand by other processes of metaphor comprehension. The concept of "time" is one of the cases that are understood in terms of

horizontal movement in the space. In this metaphorical description, future is in front of us and past is behind us.

On the other hand, the second mechanism is used to attribute a salient semantic feature of a typical member of the metaphorical class to the topic of the metaphor. For example, the feature of "rapid spread" can be the defining feature of a metaphorical class. This metaphorical category has a lot of members such as helium, oxygen, and virus. The important point is that virus is a typical member of this metaphorical class (Khatin-Zadeh & Vahdat, 2015). Therefore, the metaphor *rumors are viruses* is an acceptable metaphor that can easily be understood. The feature of "rapid spread" is very salient in the concept of virus. When virus is placed in the vehicle position of the metaphor, this salient feature is attributed to the topic. This mechanism has also been discussed through the suppression of semantic features. Banaruee, Khoshsima, Khatin-Zadeh, and Askari (2017) expounded how a broad metaphorical class is produced by a suppression- or inhibition-based mechanism through which the majority of semantic aspects are completely filtered out.

A question that might be raised here is about the nature of metaphors that are understood by these two types of mechanism. It is suggested that the first mechanism is usually used to describe highly abstract concepts. As was mentioned, the highly abstract concept of time is one of the cases that is described by motion events in the three-dimensional space. This concept has a very abstract nature. On the other hand, concepts that are described through the second mechanism have a less degree of abstractness. As was mentioned previously, degree of abstractness is not a matter of absolute abstractness or absolute concreteness. Degree of abstractness can be considered on a continuum ranging from very abstract to very concrete. Therefore, it might be proposed that those concepts which are closer to "very abstract" side of the continuum tend to be understood by the first mechanism, and those concepts which are closer to "very concrete" side of continuum tend to be understood by the second mechanism. In other words, two rather different groups of metaphors with two rather different mechanisms of comprehension are used to describe and understand two different types of concepts.

The second distinguishing point between the first and second mechanisms is that in the first one, a set of elements within a domain (source) can be used to describe another domain (target). This is particularly useful for understanding concepts on the basis of relations in the source and target domains. Since the positions of elements and their relations can easily be perceived in a three-dimensional space, this mechanism is very effective to describe concepts whose understanding involves the mapping of relations from source domain into relations in the target domain, as described by structure-mapping theory of metaphor comprehension (Gentner, 1988). Therefore, it seems that when the understanding of a metaphor involves the relations among a set of elements in a domain, the first mechanism is more effective. In such cases, the nature of relations among elements can effectively be pictured in terms of relations among a set of elements in a three-dimensional space. On the other hand, the second mechanism is used to attribute a very salient semantic feature of a concept to another concept in which that feature has a lesser degree of saliency. Therefore, the involvement of a set of elements and the nature of relations among these elements is not a matter in this mechanism. It can be said that those metaphors that are understood through the first mechanism are usually more complex, as their understanding involves a potentially complex set of relations among a number of elements in source and target domains.

One point that must not be ignored is that complexity of a metaphor is not totally dependent on the number of elements that are involved in source and target domain. Number of elements in the source and target domains is just one factor. Degree of abstractness of target domain could be another critical factor that determines level of difficulty of a metaphor. Therefore, it is a combination of a variety of factors, rather than a certain feature, that determines level of difficulty of a metaphor. Depending on these factors and the features of source and target domains, a certain mechanism might be employed to process and understand that metaphor.

7. Summary

In this article, two groups of metaphors that are used to describe two types of concepts were discussed. The first group includes those metaphors that are used to describe concepts which have a high degree of abstractness. In many cases, these concepts can metaphorically be described and understood in terms of motion or non-motion events in the three-dimensional space. This is particularly the case when a metaphor is understood through the mapping of relations from source domain into relations in the target domain. These metaphors are usually complex. When number of elements in the source and target domains is high, and the nature of relations among elements is complex, the processing of metaphor would be more complex. Degree of complexity of these metaphors can also be dependent on other factors, such as degree of abstractness of the concept that is described by that metaphor. The second groups of metaphors are those which are understood by including topic of metaphor into a metaphorical category defined by one or at most several salient semantic features. In fact, these metaphors are understood by attributing the salient semantic feature or features to the topic of metaphor. In this mechanism, a metaphorical class is created on the basis of one or several salient semantic features. Then, a typical member is selected to represent this metaphorical class. When this typical member is put in the vehicle position of metaphor, the salient defining feature of the metaphorical class is attributed to the topic of metaphor through the mediation of the typical member of the metaphorical class. Therefore, different mechanisms might be employed to process different kinds of metaphors. Degree of abstractness of the concept that is described by the metaphor and also the nature of source and target domains as well as some other features could be critical factors that determine which mechanism is employed to process the metaphor.

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Author details
Hassan Banaruee[1]
E-mail: Hassan.banaruee@gmail.com
ORCID ID: http://orcid.org/0000-0002-8004-7604
Hooshang Khoshsima[1]
E-mail: khoshsima2002@yahoo.com
Esmail Zare-Behtash[1]
E-mail: behtash@cmu.ac.ir
Nahid Yarahmadzehi[1]
E-mail: venayarahmadi@gmail.com
[1] Dept. of Language and Literature, Chabahar Maritime University, Chabahar, Iran.

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