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Article abstract

When communicating new knowledge we often use metaphors that provide understanding of one kind of experience by relating it to another. Apart from their use in basic linguistic communication, metaphorical models play an important part in communicating new discoveries in scientific theories. They also shape our experience and affect our picture of the world. The imaginative description of conceptual relations stimulates the research process, providing the basis for new discoveries.

METAPHOR IN SCIENTIFIC COMMUNICATION

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Résumé

Forme d'expression souvent utilisée dans des situations de communication courantes, le langage métaphorique permet aussi le rapprochement entre de nouvelles découvertes et des domaines de connaissances plus générales. Dans cet article, l'auteur montre comment le recours à la métaphore dans le discours scientifique facilite l'appréhension de nouveaux concepts.

Abstract

When communicating new knowledge we often use metaphors that provide understanding of one kind of experience by relating it to another. Apart from their use in basic linguistic communication, metaphorical models play an important part in communicating new discoveries in scientific theories. They also shape our experience and affect our picture of the world. The imaginative description of conceptual relations stimulates the research process, providing the basis for new discoveries.

INTRODUCTION

We could say that in communication in general, including scientific communication, conceptual categories obtain their full sense (and perhaps their full essence) only when, converted to communication signs, they enter communication channels, and thus become an interpersonal phenomenon and a potential element of collective experience (cf. Škiljan 1991: 112).

Regarding of the relationship between language and mental phenomena, one of the fundamental precepts of cognitive linguistics is the idea of their close interrelation. The fundamental cognitive abilities and experientially derived cognitive models have direct and pervasive linguistic manifestations, and conversely, the language structure furnishes important clues concerning basic mental phenomena (cf. Langacker 1993: 1)

In order to communicate new knowledge in any field of human experience, including areas of science and technology, we need language structures which can express new conceptual categories. However, if a new word had to be created to express each new scientific experience, language would become increasingly complex and intricate. New conceptual structures are, therefore, frequently described with elements already existing in the language.

One of the ways of creating new language structures by means of existing ones is a metaphorical use of the language. New experience is frequently expressed via metaphor which help us to comprehend it. By means of metaphors the structures from one conceptual domain are mapped to another, thus making it possible to understand one type of experience by means of another.

Our conceptual system and, consequently, our language system are largely made of metaphors based on physical and cultural experience of a given community. Describing the unknown by means of the known experience, metaphors facilitate the communication process. However, once created, the metaphorical models also play another important role: they have a considerable back effect on our experience and our actions.

To illustrate the metaphorical use of language, we shall quote a few examples given by Lakoff and Johnson (1980: 47). Thus, for example, within the metaphorical model "ideas are plants," we find the following expressions:

His ideas have finally come to *fruition*.
Mathematics has many *branches*.
The seeds of his great ideas were *planted* in his youth.
She has a *fertile* imagination.

Or within the model "Love is war":

He is known for his many rapid *conquests*.
She *fought for* him, but his mistress *won out*.
She *pursued* him *relentlessly*.
She is *besieged* by suitors, etc.

It might seem at first sight that metaphorical expressions of the conceptual models do not comply with any particular rules. However, a closer examination would show that when humans consciously use metaphors, they subconsciously follow certain guidelines. They tend to compare items from different semantic fields which share minor but obvious characteristics (cf. Aitchison 1995: 156).

METAPHOR IN ELECTRONICS TERMINOLOGY

The communication of a particular scientific community is usually based on a specific language segment created around the cognitive models relevant for that community. In this communication process they frequently use the metaphorical models, again specific for the given community.

In electronics terminology, for example, we can frequently find the denominative metaphor, called by Ricœur a "linguistic metaphor." Ricœur says that it "consists in forgetting, eliminating, i.e. 'abstracting' [...] a number of attributes associated to the metaphorically used term in its normal use. For example, when a line of people is called a 'queue', we neglect all its traits except length." Ricœur finds that the basic conception of a linguistic metaphor is its tendency to name an object by means of the most typical representative of one of its attributes (cf. Ricœur 1981: 122-123).

Thus, for example, one of the basic electronics terms, (*electric*) *current* has been created by metaphorical extension, in comparison with the current of water, or the current of air, on the basis of common characteristics of movement, since electric current denotes the movement of electric charges. However, metaphors frequently surpass the mere association of two concepts which have some common characteristics. Such denominative extensions of meaning frequently activate whole situations or "frames." Around the term *current*, therefore, a whole metaphorical model has been developed, and we speak about a *current source*, as a "point from which the current flows," about the *ripple of current*, its *leakage*, *drain*, etc.

Imaginative use of a language is frequently interlingual in the sense that the same metaphorical models appear in different languages. This can be illustrated by parallel examples taken from English and Croatian electronics texts:

The current flow is controlled by the variation of the electric field.
Tokom struje upravlja promjena električnog polja.
The current flows through the device.
Struja teče kroz uređaj.

However, the use of a particular model rarely overlaps in all its traits in two languages. So, for example, the given metaphorical model is applied more consistently in English than in the Croatian lexis of electronics. Thus, for example, in English, the *current flow* is *high* and *low*, like the current of a river:

In the forward-bias region, *current* rises rapidly [...] and is quite *high*.
Current in the reverse-bias region is usually much *lower*.

In Croatian translation, however, we speak about *little* and *big* (magnitude of) *current* (*mali i veliki* iznos *struje*).

Metaphor can also be found in conceptual and linguistic models of electronic computers. An example would be a metaphorical image of software as a human being. Thus, the software can be *intelligent*, *user-friendly*; it has its *life cycle*, its *tools*, and can, occasionally, also have its *bugs*. In the process of communication between the computer and its user, software also uses different *languages*, which, during the *information transfer*, just like any other language, behave in accordance with the rules of *syntax* and *semantics*.

METAPHOR IN SCIENTIFIC THEORIES

Besides their use in basic communication of a scientific community, metaphorical models frequently play an important part in devising and communicating new knowledge and new discoveries in scientific theories. When communicating the new experience scientists frequently use metaphors to attire the new concepts, thus making the new knowledge familiar not only to the others, but sometimes also to themselves.

Those who look at science from the empiricist point of view and see it as dealing only with strictly defined categories believe that the use of figurative speech might be not only imprecise, but also misleading. John Locke, for example, says:

> "...if we would speak of things as they are, we must allow that all the art of rhetoric, besides order and clearness; all the artificial and figurative application of words eloquence hath invented, are for nothing else but to insinuate wrong ideas, move the passions, and thereby mislead the judgment..." (*An Essay Concerning Human Understanding*, book. 3, chap. 10)

In cognitive theory, however, it is pointed out that our concepts are based not only on "inherent," objective features of objects or phenomena, but also on our interaction with them. Our understanding of the world, therefore, arises from our interaction with our environment and with other people. Lakoff (1990: 299) says that knowledge, like truth, depends on our understanding, most centrally on our basic-level understanding of experience. He believes that the same is true for scientific theories. They must be coherent with our basic-level perceptions and accepted by relevant scientific communities in order to be generally accepted as true. Once they are, they become part of our knowledge because they provide the only socially acceptable understanding available. Knowledge is, therefore, basically a human category, formed in relation to our understanding. Similarly, cognitive linguistics views meaning as something that does not exist in itself, but only in relation to a real or hypothetical member of a speech community. This view makes it easier to understand the metaphorical use of language which combines understanding and imagination, thus pro-

viding the means of communicating new knowledge and inciting the process of creative thinking which, in turn, leads to new scientific discoveries.

THE BOHR MODEL

Take, for example, the model of atom proposed, after several inadequate propositions made by other scientists, by Niels Bohr in 1913. It explains the structure of atom by analogy with the solar system in which there is a central nucleus around which revolve planets — electrons. When we say that a concept is expressed metaphorically, it usually means that it has taken only a part of the features of the original model and can be extended in a certain sense, but not in just any sense. It must be noted, however, that the value of the model is by no means impaired by this restriction. So, in the metaphorical model of an atom, the real physical center of attraction does not exist. However, overall interaction is such as to simulate the real center of attraction. Similarly, there are no real physical orbits of electrons in the sense that their position and quantity of motion (momentum) would be known in any given case. Nevertheless, we can say that they exist inasmuch as they are clearly separated and each has corresponding energy.

In addition to their communicative function, metaphorical models frequently have an important scientific function. The picturesque description of conceptual relations frequently lays a foundation for further investigation of the domain within the given model, thus stimulating the research process and leading to possible discoveries of new relations within the model. Thus, for example, Bohr's model confirmed the validity of the hypothesis regarding the consideration of microscopic phenomena in the light of the quantum theory. Only after the introduction of Bohr's model were the revolutionary views introduced into the theory of quantum physics, and as a result, the phenomena within the nucleus began to be viewed in a completely new light. Within the frame of the generalized Bohr's model, physicists soon started talking about the orbits of electrons and protons within the nucleus itself and the relativity theory showed that the electron has a "rotation" around its own axis which are continuations of the analogy with the planetary system. Bohr's model has also shed new light on chemical phenomena in atoms. In short, it has led to the discovery of a whole wealth of phenomena in the microworld.

THE GENETIC MODEL

Molecular biology, on the other hand, uses the linguistic model to explain the flow of genetic information. The process of transcription of DNA to RNA is followed by translation of RNA to proteins in accordance with instructions given in RNA templates.

A code word consisting of three letters of the genetic alphabet designates an amino acid. However, an amino acid can be designated with more than one code word or codon. Codons specifying the same amino acid are called synonyms. Most synonyms differ only in the last base of the triplet.

This metaphorical model has offered the basis for a rich superstructure. So, for example, describing the evolution of the genetic code, Smith and Szathmáry speak of *ambiguity in translation*, describing the original translation mechanism which reached a propitious *translation fidelity* in the course of evolution. In the text titled, "How can translation work if it is highly ambiguous?," they claim that *ambiguity* can be of special importance in the context of translation and can lead to an "error catastrophe." Sup-

pose that *translation errors* lead to the production of malfunctioning proteins... suppose that some malfunctional proteins are themselves used in translation... Then a single error... could cause several errors in the next round. If so, there would be an exponential increase in the frequency of errors: an error catastrophe (cf. Smith and Szathmáry 1995: 94).

THE LINGUISTIC MODEL

The given examples show that in the process of communicating a new knowledge, relevant scientific communities frequently reach for metaphorical models from the domain of other sciences. Thus, the physical theory uses the astronomic planetary model and genetics uses a linguistic model.

Linguistic theory, however, describes the communication process by means of a metaphor from the field of electronics. Thus the generally known communication model described by Lyons on the basis of the model described by Shannon and Weaver (1949), includes all elements of an electronic transmission link: transmitter, signal transmitted, channel, received signal, and receiver. Lyons explains that "it is important to realize that the terms in question are of much wider applicability than their origin in communications-engineering might suggest; and they should not be thought of as referring solely to some electrical, mechanical or electronic system of signal-transmission" (Lyons 1978: 36).

Explaining this model of communication as transmission of information between the source and receiver using a signalling system, Crystal says that "in linguistic contexts, source and receiver are interpreted in human terms, the system involved is a language, and the notion of response to (or acknowledgment of) the message becomes of crucial importance" (Crystal 1991: 64).

The same cognitive model can sometimes be expressed by different metaphors which need not necessarily be consistent, and each of them can concentrate on a different aspect of the given model. Thus, in his work *Metaphor and Thought* (1979) Michael Reddy describes the communication process by means of the "*conduit metaphor*" in which ideas or meanings are objects, linguistic expressions are containers, and the meaning stored in these containers is sent from the speaker to the hearer along a conduit.

Langacker, however, contests Reddy's model. He believes that the conduit metaphor often leads to conceptual difficulties. It leads to the conclusion that all facets of the linguistic meaning of a lexical item are carried along together. However, Langacker claims that in actuality nothing travels from the speaker to the hearer except sound waves. To the extent that the two speech-act participants employ the same symbolic system and command comparable knowledge structures, the listener is able to reconstruct from the acoustic signal a reasonable hypothesis about the nature of the conceptualization that prompted the speaker's utterance. Instead of regarding expressions as *containers* for meaning, Langacker believes that we must focus on the symbolic *correspondence* between a phonological and a semantic structure (cf. Langacker 1987: 161).

Langacker adds new ideas to our understanding of the communication process, but still using the metaphorical model which, in spite of different interpretations and modifications, still retains its basic metaphorical structure.

Describing the communication process from a somewhat different angle, Jean Aitchison uses the metaphor which is also based on our knowledge of the effect of electric current. Referring to the way in which words from our mental lexicon are acti-

vated during the process of speech production, she speaks about "the complex electric circuitry in which current flows backwards and forwards between particular points, and in so doing excites numerous other points around. The relevant points and links get more and more excited, and the irrelevant ones get suppressed, until finally one word wins out over the numerous others activated" (Aitchison 1995: 208). The same process is repeated in the process of word recognition. As in speech production, speakers consider many more words than they eventually select. "A large number of words are activated, and those that are not required are gradually suppressed" (Aitchison 1995: 222).

Geeraerts thinks that we should change our metaphorical images of meaning including both the image of conduit metaphor of verbal communication and that of the lexemist conception of the mental lexicon. He believes that the common characteristics of both metaphorical complexes is that of reification: "meanings are things, prepacked chunks of information, that are contained in and carried about by word bags" (cf. Geeraerts 1993: 259). However, he thinks that "the tremendous flexibility that we observe in lexical semantics suggests a procedural (or perhaps 'processual') rather than a reified conception of meaning; instead of meanings as things, meaning as a process of sense creation. He proposes a new metaphor, which, like the metaphor of the communication channel, is based on electricity, i.e. the phenomenon arising from it. To make the concept of meaning more understandable, he proposes the image of the floodlight: words are searchlights that highlight, on each application, a particular subfield of their domain of application" (Geeraerts 1993: 260).

CONCLUSION

We can, therefore, conclude that the codes of particular scientific disciplines, aiming at transferring knowledge to members of a more or less restricted scientific community, or even to members of a non-scientific community, frequently use metaphor in order to communicate meaning in the best possible way. It is a known fact that even when both participants of the communication process share the same knowledge, meaning can rarely, if ever, be transferred in its entirety. Metaphorical imagination is, therefore, essential for communicating experience which is not shared. As we have seen in the examples given, when describing this new experience, scientists frequently use both conceptual and language models already offered in some other branch of science. By describing unknown knowledge by means of the known, they facilitate the communication process. Aristotle himself said in his Poetics: "Common words transfer only what we already know, it is by means of metaphor that we can understand something new."

We can also conclude from these examples that, besides their communicative function, metaphorical models also have an important scientific function. On the one hand, they shape our experience of the world and, to a great extent, determine our world. (It is highly probable that a different description of a scientific theory might direct the development of the given science, and, consequently, our conception of the given new experience, in a different direction.) On the other hand, a picturesque metaphorical description of conceptual relations also plays an important role in stimulating the research process, thus creating the basis for new scientific discoveries.

Although, owing to ever increasing quantity of information within a particular discipline, the codes of scientific disciplines tend to be increasingly diversified, the given examples lead us to the conclusion that, on a deeper level, cognitive and linguistic models used by particular scientific communities are mutually inseparably related.

Or, to express it more exactly, we could say that particular scientific knowledge is, and has always been, only a part of universal knowledge, which has been divided and limited by frames of particular disciplines in our attempt to categorize, explain and understand our world. This tendency towards universality is also characteristic of linguistic science in which we can also recognize a tendency to interact with other sciences and to erase the limits between linguistic and nonlinguistic knowledge.

REFERENCES

AITCHISON, J. (1995): *Words in the Mind*, Oxford, Cambridge (Mass), Blackwell Publishers.
CRYSTAL, D. (1991): *A Dictionary of Linguistics and Phonetics*, Cambridge (Mass), Basil Blackwell.
GEERAERTS, D. (1993): "Vagueness's puzzles, polysemy's vagaries", *Cognitive Linguistics*, Berlin, New York, Mouton de Gruyter, 4, 3, pp. 223-272
LAKOFF, G. and M. JOHNSON (1980): *Metaphors We Live By*, Chicago and London, The University of Chicago Press.
LAKOFF, G. (1990): *Women, Fire and Dangerous Things*, Chicago and London, The University of Chicago Press.
LANGACKER, R. W. (1987): *Foundations of Cognitive Grammar*, Vol. I, Stanford, Stanford University Press.
LANGACKER, R. W. (1993): "Reference-point constructions", *Cognitive Linguistics*, Berlin, New York, Mouton de Gruyter, pp. 1-38.
LYONS, J. (1978): *Semantics*, Cambridge, Cambridge University Press.
REDDY, M. (1979): "The Conduit Metaphor", A. Ortony (Ed.), *Metaphor and Thought*, Cambridge, Cambridge University Press, pp. 284-324.
RICŒUR, P. (1981): *iva metafora*, Zagreb, Grafički zavod Hrvatske.
SHANNON, C. and W. WEAVER (1949): *The Mathematical Theory of Communication*, Urbana (Ill), University of Illinois Press.
SMITH, J. M. and J. SZATHMÁRY (1995): *The Major Transitions in Evolution*, Oxford, New York, Spektrum.
ŠKILJAN, D. (1991): *Kraj lingvistike*, Zagreb, SOL.