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ФИЛОЛОГИЈА, КУЛТУРА И ОБРАЗОВАНИЕ

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# METAPHORS IN TECHNICAL-SCIENTIFIC TEXTS

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## **ABSTRACT**

The main purpose of this article is to present metaphor from a different perspective: not as a stylistic or rhetorical element, used in literary texts, but as an important means of creating specialized terms in technical and scientific language. The role of metaphor in terminologization has been highlighted by many linguists, who have analyzed the complexity of this procedure and concluded that figures of speech used in technical communication must be distinguished from those used in works of fiction, because, although the conceptual mechanism is the same, being based on the transfer of meaning from one reality to another, the value is different; in technical-scientific texts, metaphors are not meant to embellish an otherwise plain or dull style, but to assign terms to concepts in a way that is both precise and easy to understand by the speakers. The dichotomy between metaphor as a stylistic device in LGP (i.e. language for general purpose) and metaphor as an element used in terminologization in LSPs (i.e. languages for special purposes) is rooted in the distinction between the rhetorical and the semantic value of a word or term. Therefore, a thorough study of this figure of speech implies various perspectives on the multiple possibilities of expression based on metaphors. This paper provides only an overview of the complex issue of metaphORIZATION in Terminology, to which I intend to dedicate a large part of my future research.

**Key-words:** metaphors; Terminology; LSPs; technical-scientific texts.

Endowed with a strong persuasive character, due to its ability to assimilate an unknown or less known concept to a familiar one, metaphor has been used as a rhetorical device since ancient times, being studied by all the important writers and philosophers interested in the art of speaking and convincing the audiences, from Aristotle to the representatives of the Enlightenment.

Up to the 20<sup>th</sup> century, it was considered only a figure of speech, whose sole purpose was to “adorn” a text, be it written or oral, by making its style more persuasive or more entertaining for the readers or listeners. From this point of view, it was considered incompatible with technical-scientific texts, whose main objective was to inform or to instruct and whose principal requirements were precision, accuracy, objectivity and straightforwardness. Moreover, metaphorical language was seen as the attribute of occult or less respected disciplines, like alchemy. Therefore, it was despised by renowned scientists like Linnaeus and Lavoisier, who tried to “cleanse” the language of their sciences (biology and chemistry) of all the subjective marks of expression (figurative meanings, polysemous words, rhetorical devices, etc.).

The imprecision implied by metaphors was despised up to the creation of the new discipline of Terminology, in the 1930s, when the linguists who embraced this field understood the potential of rhetorical devices in enlarging the nomenclatures of various domains. Instead of considering metaphors as sources of ambiguity, interpretability and inexactness, the representatives of the newly emerged schools of Terminology emphasized their immense creative potential, which was beneficial for the development of diverse LSPs. For example, the language of cybernetics, created in the 1940s, is almost exclusively based on the use of metaphors, because, as a revolutionary interdisciplinary science, it needed to create a whole new lexicon from scrap. In so doing, it either invented completely new terms, such as “invironment”, which is a blended compound referring to the internal environment of the subsystems within a system, or extended the meanings of already existing words, by metaphor (e.g. noise, defined as “a random perturbation of a system’s state”, or “constraint”, explained as “a relation between two sets of objects, implying that the variety that exists under one condition is less than the variety that exists under another condition”<sup>1</sup>).

Although metaphors and technical-scientific communication were seen as incompatible for many centuries, a different approach could solve the problem in the easiest way, by simply considering metaphor from two distinct viewpoints. Rhetorically speaking, it is, indeed, undesirable in various forms of precise communication, because it may lead to inaccuracy and equivocalness; from this point of view, its sole purpose is to embellish an otherwise dull text and, as a result, it is suitable for literary or journalistic texts, in which adornment is highly welcome. On the other hand, semantically speaking, metaphor is a method to join two different semantic fields and, therefore, significantly contributes to enriching the general lexicon of a language, as well as diverse terminologies of technical-scientific domains. From this perspective, it is a desirable semantic procedure, embraced by both lexicologists and terminologists when introducing new words and terms into a language.

According to Lakoff and Johnson’s approach (1980), metaphor as a linguistic procedure is neither exclusively rhetorical, nor entirely semantic, but it is

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<sup>1</sup> All the definitions in this article are taken from [www.thefreedictionary.com](http://www.thefreedictionary.com)

endowed with multiple connotations, depending on the context in which it is used. Embedded in our conception about the surrounding universe, metaphor is mainly a mechanism of thought, whose role in understanding the world can be valued both in everyday situations and in forms of technical-scientific communication. Therefore, it is considered neither an “ornament”, nor a “bridge” between two different semantic fields, but a way of perceiving a new or less known reality in terms of something familiar and easy to understand. This mechanism is applied both in the daily aspects of life (e.g. a group of schoolchildren walking two by two looks like a crocodile, so we name it accordingly) and in technical contexts (e.g. the hole in a hammer looks like an eye, so we call it “the eye of the hammer”, a TV antenna looks like a Christmas tree, so it is named “a Christmas tree antenna”, and so on).

Inspired by Lakoff and Johnson’s studies on metaphors, Rita Temmerman (2000) focuses on the idea that, in science and technology, it is very important to accurately describe the features of an object and, for a plus of precision, it is advisable to introduce these characteristics in direct connection with those of familiar items. For example, due to its specific features (i.e. the size, the grey color, the rapid moves, the attached cable looking like a tail), the hand-operated electronic device that controls the coordinates of a cursor on a computer screen has been called “a mouse”, based on the similarity with the rodent mammal. Thus, metaphorization comes as a response to the necessity of explaining new technological concepts in relation to well-known realities and, at the same time, shows a great deal of creativity in the creation of new lexical units.

Rita Temmerman’s terminological project, based on examples from the field of Biology, was meant to explain the production of neonyms<sup>2</sup> as an essential part of humans’ creative analogical thinking. First of all, she distinguished between two types of metaphors implied in neonymy: didactic metaphors, created with a view to explaining a certain concept in a simpler way (e.g. the term “computer virus” was chosen to refer to a malware program that damages a computer system because the concept is easier to understand in connection with a harmful microorganism that replicates in the same way), and creative metaphors, which provide a suggestive name for a reality (e.g. the names for various body parts have a Greek or Latin etymology based on metaphor: “thorax” initially designed, in Greek, a part of an armor, the breastplate, and “fibula”, in Latin, meant “pin”). Creative metaphors are more frequently used in the creation of phrases or idioms, which are more difficult to understand because of their connotations. For example, it is quite hard to distinguish between the proper meaning of the adjectival phrase “a white elephant” and its metaphorical counterpart, used as a specialized term in economics for designating an expensive property, implying high maintenance costs and seen as a financial burden by its owner.

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<sup>2</sup> The term “neonym” was coined by Guy Rondeau in 1984, in order to refer to the introduction of a neologism in the terminology of a specific field.

Besides Rita Temmerman's classification of metaphors in technical communication, there are some other studies that provide a categorization of metaphors according to more complex criteria. One of these classifications belongs to Zoltán Kövecses, who, in his book entitled *Metaphor in Culture: Universality and Variation* (2005), establishes various ways to distinguish one type of metaphor from another, identifying several pairs of opposites:

1. Conceptual vs. linguistic metaphors

Whereas a conceptual metaphor associates a concept from a certain field to a similar concept from another domain, a linguistic metaphor provides the lexical expression of this relationship. For example, for the concept of theories as buildings, there are some suggestive metaphorical expressions, such as “to build”, “to buttress” or “to construct” an argument.

2. Simple (or primary) vs. complex (or compound) metaphors

Simple metaphors, also known as “tight”, imply only one connection between the main concept and the one with which it is assimilated. In other words, both concepts have an exclusive representation, which can be transferred from one to the other. Therefore, the cognitive implication is minimal, as any speaker of the language in question can understand the intention of the author of the metaphor. For instance, “to crop an image” means to remove some parts of it, which can easily make you think of the denotative meaning of the verb “to crop” (= to cut the tops or ends of something, usually a plant).

On the other hand, a complex metaphor is based on diverse representations of the same concept, which leads to secondary metaphoric contents. For example, the term “Bluetooth” is hard to understand without having a cultural background, because, at first sight, there is no connection between the device of wireless technology and the abnormal condition of an anatomical part. This is the reason why one needs further information, which leads to secondary connotations. The origin of this metaphorical technical term is complex: “Bluetooth” was the nickname of King Harald Gormsson, who united Scandinavia in the 10<sup>th</sup> century and converted the Danes to Christianity. Two of the inventors of the wireless standard read his biography and decided to use his nickname for their creation, in order to show that their companies, Ericsson and Intel, were “united” in the new approach of wireless technology and intended “to convert” people to the new “religion” of a universally accepted device.

3. Submerged vs. synecdochic metaphors

The term “submerged” refers to the fact that this type of metaphor is based on only one of its elements, which carries the connotation, as it is the case in the following example: “leaf objects in active directory”. The word that carries the meaning of the entire metaphor is “leaf”, which makes the conceptual connection between the way the leaves are

displayed on the branches of a tree and the way the files and folders (i.e. the leaves) are organized in the active directory of a computer.

The synecdochic metaphor is very similar to the submerged one, as it is also based on only one element out of several parts of a phrase, but the difference is that the part chosen to render the metaphorical meaning represents the entire concept, the whole, and the other elements are no longer explicitly mentioned. For example, the term “boot”, used in Computer Science to refer to the process of turning on the computer and loading the operating system, originates in the term “bootstrapping”, which defines the way in which people used to take their boots on, when getting ready to go out. Thus, the metaphorical meaning is based on an ampler concept, out of which only one part is explicitly rendered.

Unlike Zoltán Kövecses, who is very specific in defining and classifying metaphors, Gibbs and Steen (1999) see them as a whole and consider that the process itself “plays a major role in our understanding of individual words, especially in making sense of how a single word can express a multitude of related meanings (i.e. polysemy)” (Gibbs & Steen, 1999:37). They are mainly interested in the role of metaphors in creating new terms and add that terminologization based on these figures of speech helps to express very complex ideas “in a simple, elegant manner that transcends the boundaries of language and culture” (Idem). From this perspective, metaphor is a valuable tool in enriching the vocabulary of a technical or scientific field and in enabling the experts in a domain to spread their specialized knowledge amongst laymen.

Seen as one of the fundamental principles of language or as “the main mechanism through which we comprehend abstract concepts and perform abstract reasoning” (Lakoff, 1993:244), metaphor is deeply rooted in the way we relate to the world. Not only in everyday language, but also in the technical-scientific jargon the most productive metaphors are the ones based on natural elements, such as plants, animals and parts of the body, as well as various processes associated to animal life.

A very frequently used technical metaphor contains the word “nut”, which enters various combinations and also functions as a standalone unit; due to its round shape, this fruit is assimilated with a circular fastening device, with a number of flat surfaces on the outer rim and threads on the inner hole. Phrases like “butterfly nut” (i.e. a threaded nut with projections similar to wings – hence the similarity with the butterfly – for thumb and forefinger leverage in turning) or “castle nut” (i.e. a nut with slots cut into one end, in the shape of the crenellated parapets of a medieval castle) are worth mentioning, since they form complex metaphors.

Other plants that should be included here are reed, which is the head of a metaphorical noun phrase, “reed valve”, referring to a check valve that restricts the flow of fluids in a direction, “tulip” and “daisy”, whose shapes are at the basis of many conceptual metaphors. Specialized terms, used in many fields, from the technical to the medical domain and from Marine Biology to Interior Design, are

related to the similarity in form between a tulip and various objects, such as “tulip valve”, “tulip shell”, “tulip bulb aorta” or “tulip chair”. Due to the same similarity of shape between the flower and various round components, “daisy” is also very much used in term creation by conceptual metaphors. For example, in Computer Science the term “daisy wheel” designates a component of a computer printer in the shape of a wheel with many spokes and “daisy chain” refers to a means of connecting devices to a central processor by party-line input/output buses which join these devices by male and female connectors. The phrase “daisy chain” (i.e. a series of interconnected parts, activities or events) is very productive in itself and enters many compound expressions from diverse domains: “daisy-chain structure” and “daisy chain mine pattern” in the military domain, “daisy chain bus”, “daisy chain logic” and “daisy chain network” in Computer Science.

An interesting conceptual metaphor based on plants is the phrase “dead tree version”, which designates the printed version of a document, in order to refer to the useless consumption of paper (made of pulp obtained from “dead trees”), in opposition to the electronic version of the same document, which is more environmentally friendly, not to mention faster and easier to access.

The similarity of shape, frequently used in the case of terminologization by metaphors related to names of plants, is also exploited in metaphors containing names of animals. For example, the shape of a camel’s hump provides the metaphorical vehicle for creating terms in Civil Engineering and Computer Science: a “camel-back truss” designates a truss made up of straight segments displayed in a humped shape, whereas “camel case” is a naming convention amongst IT specialists, according to which the first letter of either word in a compound must be capitalized and, therefore, the entire compound will look like a Bactrian camel with two humps. In the same way, the shape of a hawk lies at the basis of a conceptual metaphor used in Civil Engineering for designating a flat wood or metal tool, provided with a handle, which plasterers use for carrying plaster, mortar or mud.

Not only the names of animals as such are used for creating new terms based on metaphors, but also their actions. For instance, the meaning of the verb “to hibernate” has been transferred from the animal world to Computer Science. Similarly to a bear in winter, a computer “hibernates”, meaning that it saves the current state of the system and, when restarted, it automatically loads the saved state into the RAM. Another complex metaphor involving the action of a bear is the one based on the similarity of effect between the heavy punch of the animal and the extreme force, pressure and weight of a portable spot perforator used in metallurgy for engraving coins.

Besides the metaphors that imply either the similarity of shape or the similarity of function between one concept and another, there are those that combine the two criteria, relying both on the shape and on the function of the source and target concepts. For example, the term “bulldog clip” is used for referring to a paper clip with a spring that closes the metal jaws, which resembles the jaws of a bulldog both in form and in grip strength. Another term like this, “spider trunnion”, used

in Engineering for designating a coaxial projection attached to the opposite sides of a container, a cannon, etc., to provide a support that can be rotated, is based on the similarity of shape and ability to extend to different parts that a spider has when making its cobweb. The same likeness of shape and function can be remarked in the case of the phrase “alligator shears”, referring to some heavy shears for cutting metal slabs, which look like the teeth of an alligator and have the same force and sharpness.

Some complex metaphors, based on the similarity of shape and function, contain both the name of an animal and that of a body part. This is the case of the term “beavertail”, used both as a single-word term and in various compounds in many fields. When it is used as a standalone lexical unit, it refers either to a type of doughnut, in the field of Gastronomy, or to a species of cactus, in Botany. In compounds or phrases, it is used in many domains, from the automotive industry, where a “beavertail truck” designates a particular type of auto trailer, with an inclined platform that can be lifted or lowered like the tail of a beaver, to Physics, where the term “beavertail beam” is used in electromagnetism to refer to a fan-shaped radar beam, wide in the horizontal plane and narrow in the vertical plane, swept up and down for height finding (here, again, the similarity with the shape and function of the tail of a beaver is obvious).

Various types of metaphors based on parts of the body are very frequently used in technology, due to the similarity of shape and/or function between technical devices and diverse body parts, mainly “head”, “eye”, “ear”, “neck”, “elbow”, “knee”, “hip” and “foot”. The most productive and frequently used is “head”, which both designates the uppermost part of some equipment and is meant to underline the importance of a certain part of a machine or gadget. For example, in Hydraulics, a “low-head dam”, as opposed to a “high-head dam”, is a structure of less than five meters, which crosses the full width of a stream and creates a pool of backwater, whereas in Constructions, more precisely in roofing (hence the connection with the part of the body), a “head lap” designates the shortest distance from the lower edges of an overlapping shingle to the upper edge of the unit in the second course below.

Metaphorical terms in science and technology including the word “eye” are numerous, due either to the round shape of the anatomical part or to its function of seeing. Two examples are eloquent in this respect: in Engineering, an “eye bolt” refers to a threaded bolt, the head of which is formed into a ring (or “eye”) for lifting, pulling, or securing, whilst in Computer Science an “eye candy” is colloquially used for the images included on a web site to make it more attractive; the equivalent for the sound effects on a web page is another metaphor based on parts of the body, “ear candy”.

The double metaphor, in which the word “candy” is metaphorically used with the meaning of a “treat” for the eye or for the ear, is just an example taken from a very large category of metaphors based on food products or other ordinary things. In the same classification, we can include the technical term, “cheese head”, which refers to a screw or bolt with a cylindrical slotted head (these slots are the



metaphorical vehicle towards the concept of Swiss cheese). Moreover, some ordinary items, whose physical or functional features resemble those of other things, are used in conceptual metaphors, such as “apron wall” (i.e. an exterior wall that extends downward from a windowsill to the top of a window below, just like an apron) and “cloud computing” (i.e. a model meant to facilitate network access to a shared pool of configurable computing resources resembling a cloud). To put in a nutshell all the theories on metaphors mentioned in this article and illustrated with relevant examples, we can say that the main functions of metaphors in science and technology are the following:

- To designate a certain discovery or invention in a meaningful way;
- To explain a theory in comprehensible terms, so that science and technology could be popularized;
- To present the outcomes of a technical-scientific breakthrough in a manner that can be easily understood.

In conclusion, metaphor is the most productive figure of speech used in Terminology and has a huge potential for creating terms (including compounds and phrases) in many fields of technical-scientific communication, which is the reason why linguists should dedicate it more studies and terminologists should take more advantage of its numerous facets of meaning.

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