The Presence of Metaphor in Scientific and Technical Communication

Evelina GRAUR
evelina.graur@usv.ro
Stefan cel Mare University of Suceava (Romania)

Résumé: La présence de la métaphore comme manifestation *cognitive* et comme manifestation *verbale* dans l'espace de la communication technique et scientifique est une évidence discursive. Par le biais de quelques observations, cet article se propose de reconstruire la conviction de Marshall McLuhan selon laquelle la métaphore est un principe majeur qui gouverne le monde des *artefacts humains* et d'inventorier brièvement les fonctions détenues par celle-ci dans le monde scientifique et des nouvelles technologies.

Mots-clés: métaphore, modèle mental, instrument, fonction, interaction.

Reading the following excerpt from Kövecses (2010: 311), we can rest assured that *metaphor studie*s have reached a moment of glory: "We now know incomparably more about the locus of metaphor than ever before. Metaphor is not only in language, and it is not only in language and thought, either. Metaphor is a widely distributed phenomenon that encompasses all our cultural reality – including material culture and physical events. Making sense of our world cannot take place without metaphor. But metaphor can also be found in the body. Metaphorical embodiment is especially important when it provides motivation for the emergence of particular conceptual metaphors. The brain runs the body, and what the body experiences is registered by the brain. Ultimately, it is in the brain's neurons where metaphors reside and where we produce metaphorical thought. Thus the study of metaphor in the past nearly three decades identified metaphor in: Language – Thought – Culture – Body – Brain."

The linguist warns us, however, that the proposed succession "is not a temporal sequence of loci where metaphor unfolds", but "a sequence of discoveries (and the consequent exploration) of the realms where metaphor resides, the latest one being the brain" (*ibid*.). Núñez (2008) argues, for instance, that mathematics arises naturally from the interactions of our brains, bodies and experiences with the world, and that conceptual metaphor (understood as a neural mechanism that allows us to use the inferential structure of one domain to reason about another) plays a crucial role in the genesis of mathematical ideas. Thus, the author suggests that in order to conceptualize the technical mathematical concept of 'class', mathematicians resort to the everyday concept of 'a collection of objects in a bounded region of space'. Similarly, 'subtraction' resides in 'distance' and 'derivative' calls for 'instantaneous change'. Even more recently, scholars such as Ruiz de Mendoza Ibáñez and Hernández (2011: 165) consider the Neural Theory of Metaphor a very strong hypothesis resting on the observation that "many languages make use of the same conventional metaphors, which are grounded in common motor-sensory experience." As a matter of fact, the idea that *we are what we think* was validated by Thibodeau and Boroditsky (2011) who discovered that conceptualizations such as CRIME IS A BEAST and CRIME IS A VIRUS elicit different responses from people; in the first case people are more likely to call for strong law enforcement, whereas in the latter they are more open to solutions such as rehabilitation and the understanding of root causes.

In her attempt to "tempt researchers with the possibilities of using metaphor in their own research", Lynne Cameron admits that finding a satisfactory definition of *metaphor* is not easy and often implies sacrificing one's avowed preferences. Thus, although she acknowledges her affinity for Burke's definition (i.e. "Metaphor is a device for seeing something in terms of something else") she immediately dismisses it because "metaphor is described using two imprecise metaphors: *device* and *seeing* (Cameron and Maslen, 2010: 3; emphasis in original).

We wonder, however, if this alleged imprecision would be truly eliminated if one replaced the word "device" with "tool" and the word "seeing" with "construing". In fact, natural languages accommodate two types of indeterminacies: one is *poetic* and refers to the fact that "one can use all of the language's properties for aesthetic and indefinitely creative ends", and the other one is *representational*, which implies that "language allows for an infinite number of new contents for beliefs, intentions, feelings, and values, and indeed, new modes of believing, feeling, and acting" (Kockleman, 2005: 291). And yet, when the editors Cameron and Maslen state in the preface of their book that metaphor "*offers a tool* that researchers across applied linguistics, social sciences and the humanities can use to reveal more about how people think and feel" (2010: ix, our emphasis), they do not propose a more precise *working definition*, but merely embrace an *instrumentalist* perspective. Within this perspective, *metaphor* reveals its 'raw nature', namely 'something to be used or employed for a purpose' and becomes, just as Ortony (1975) suggested, "necessary and not just nice".

In specialist scientific discourse metaphors have a primary *generative* function in that they are employed to create ideas, construct hypotheses, and build theories. Boyd (1993)[1] calls this category of expressions *theory–constitutive metaphors* because they represent original scientific thought and terminology which cannot be replaced by paraphrases. What it means to "see" matter at the atomic level involves two levels of response: "First we must remember that any model we might use to characterize the atom is metaphorical, whether it be that of a billiard ball, a plum pudding, a miniature solar system, a cloud of negative charge surrounding a positive center, or a densely mathematical description based on quantum theory. Our experimental attempts to see the atom as it is all involves approaches that relate observables to the atom via one or more models. Thus the images they yield are necessarily metaphorical. We don't ever "see" atoms. The images we obtain are indeed based on stable, mind-independent reality. The predictive power and utility of the images derived form X ray and STM [scanning tunneling microscope] experiments are very impressive. One is moved to think, "Surely we are really seeing the atoms here!" What we see are constructs that at their best represent reliable models of reality, with sufficient verisimilitude to serve as productive metaphors. They facilitate correlations, predictions, and interpretations of other data and stimulate the creative design of new experiments" (Brown, 2003: 99).

The other category is represented by *pedagogical/ exegetical metaphors* that merely describe or explain existing knowledge that often admits alternative formulations. Metaphorical models exploit the strategy of understanding one thing in terms of something else that is more familiar and brings more clarification especially by analogy. For instance, the functioning of a backup solar power generator system may be explained with the familiar metaphor of a bathtub and its piping. The metaphor facilitates

[1] Boyd's categorization was challenged by Knudsen (2003), who discussed the relationship between the two categories form a pragmatic and empirical perspective and managed to demonstrate that whether the metaphor belongs to one category or another does not depend on the specific metaphorical expression itself, but on context, communicative purpose and genre.

the understanding of how the battery capacity (bathtub size), solar panel size (faucet) and load (drain) determine the behavior of the whole system. However, scientific reality is more complex since there are inherent technical aspects that need to be considered beyond the similarities of mere relationships: solar panels do not produce their rated output, and there are energy losses both in charging the battery and converting the output to alternating current.

Establishing the importance of analogy for understanding a metaphor is not to claim that the analogy necessarily precedes the metaphor. Bailer-Jones (2002) argues that sometimes it is the metaphor that prompts the recognition of an analogy. The following example illustrates how analogy becomes the decisive factor in ensuring the comprehensibility of a metaphor in astronomy: "In astronomical observations, one talks about signal-to-noise ratio. *Signal* is the light emitted from the object one wants to observe; *noise* represents the uncertainty of the signal (and the *background*) due to quantum fluctuations of photon emission and thus represent a limit to the precision with which the signal can be determined. The analogy connected with the noise metaphor is to a sound signal, e.g. emitted from an interlocutor whilst noise from other people talking and perhaps a nearby road needs to be separated from the signal so as to make out the information of interest. As listeners dealing with sound waves, we are quite proficient in filtering out all those unpredictable random frequencies that could prevent us from making out the signal in which we are interested, and a comparable skill would be required for optical waves in astronomy" (Bailer-Jones, 2002: 114).

Metaphor remains essential to science because of its great conceptual power. In this respect, metaphorical phrases are carriers of information or "cognitive content"(Black, 1954 cited in Bailer-Jones, 2002: 116). Obviously coined in the realm of fantasy, yet not restricted to it, the phrase *little green men* is a metaphor for extraterrestrial intelligent life in science. The naïveté in this phrase was a convenient solution to scientists: the unexpected and unusual anthropomorphic quality promoted by the expression is evocative enough to indicate that *there is no scientific way of being specific* about the nature of extraterrestrial intelligent life.

When science refers to areas beyond human experience for which there is no previous description (or highly unsuitable ones), metaphor is summoned to solve "crises of vocabulary" (Martin and Harré, 1982: 96). Thus, to refer to extremely dense and unimaginably powerful gravitational singularities, scientists use the term *black holes.* On the official website of NASA dedicated to astrophysics, the informative and explanatory text popularizing this scientific reality opens up with a terminological warning which points to the dangers of taking metaphors literally. At the same time, the text contains less enticing phrases such as *strange object* or *fascinating object,*[2] which support the idea of 'thingness' and dismiss the idea of 'emptiness' or 'void' implied by the metaphorical expression coined by Princeton physicist John Wheeler in 1967. While to scientists a black hole is a metaphor for some astrophysical reality that cannot be directly observed with telescopes that detect X-rays, light or other forms of electromagnetic radiation, to common people it may be a metaphor for mundane aspects such as closets, the economy or even the end-of-season positions of favourite sports teams. What is perhaps equally interesting to notice is the recent migration of this term into the domain of psychology. Thus, Waldron (2013) deliberately borrowed the already famous and resonant expression to assist him in describing a complex psychological reality. The abstract of the article suggestively entitled *'Black holes'*: *escaping the void* explains the coverage of the expression *black hole* in a scientific field which looks inside our minds and not beyond out terrestrial existence. The abstract reads as follows: "The 'black hole' is a metaphor for a reality in the psyche of many individuals who have experienced complex trauma in infancy and early childhood. The 'black hole' has been created by an absence of the object, the (m)other, so there is no internalized object, no (m)other in the psyche. Rather, there is a 'black hole' where the object should be, but the infant is drawn to it, trapped by it because of an intrinsic, instinctive need for a 'real object', an internalized (m)other. Without this, the infant cannot develop. It is only the presence of a real object that can generate the essential gravity necessary to draw the core of the self that is still in an undeveloped state from deep within the abyss. It is the moving towards a real object, a (m)other that relativizes the absolute power of the black hole and begins a reformation of its essence within the psyche." As the author's statements seem to suggest, the absence of a motherly or guiding figure in someone's psyche is construed as an area where a fundamental element has gone missing and as a consequence of this 'failure to be present', the power of the resulting 'emptiness' or 'abyss' is overwhelming and harmful. And yet, what differentiates a 'black hole' in our psyche from a 'black hole' in astrophysics

[2] The opening paragraph reads: "Don't let the name fool you: a black hole is anything but empty space. Rather, it is a great amount of matter packed into a very small area – think of a star ten times more massive than the Sun squeezed into a sphere approximately the diameter of New York City. The result is a gravitational field so strong that nothing, not even light, can escape. In recent years, NASA instruments have painted a new picture of these strange objects that are, to many, the most fascinating objects in space." (http://science.nasa.gov/astrophysics/focus-areas/black-holes/, accessed in June 2015)

is the attitude towards 'correction'. Unfavorable psychological realities seem to have more chances to be neutralized (*It is only the presence of a real object that can generate the essential gravity necessary to draw the core of the self*); in other words there is some hope for someone to overcome a 'black hole' experience in his/her interpersonal or intersubjective space. As for the 'black holes' of the Universe, they cannot be tricked or controlled.[3]

Unlike science, engineering does not seek to understand the world, but remake it. This does not imply, however, that engineers are not creators of knowledge; it merely suggests that the type of knowledge that they produce (e.g. tables of tolerances or equations for complex physical processes) is a means to making something *useful*. The importance of metaphors to engineering is testified by John Smeaton, a British civil engineer who was engaged in the rebuilding of the Eddystone lighthouse in the English Channel. As his journals revealed, his entire thinking process involving the restructuring of the lighthouse was rooted in metaphorical analogies. At first, the engineer envisioned the tower structured like a cradle and then as a ship, both solutions pointing to a major benefit, namely that the tower would rock with storms. These ideas were soon discarded when he realized that the accompanying disadvantages outweighed the initial benefit. Eventually, Smeaton decided that the structure was to be modeled on the shape of the trunk of an English oak tree, considerably wider at its base than at the top. Still standing today, the lighthouse is "a testament to the concrete value of metaphor as part of the engineer's thinking process" (Giles, 2008: 3). At the same time, this avowed metaphorical strategy is very much in keeping with the classic definition of civil engineering of the Smeatonian Society of Civil Engineers, the first and oldest society of engineers in the world bearing the name of its founder and metaphor-driven engineer: "[…] the art of directing the great sources of power in Nature for the use and convenience of man" (cited in Davis, 1996: 98).

[3] As the following fragment from the Reference Desk of the official Hubble Site suggests, black holes have implacable consequences: "If the core remaining after the supernova is very massive (more than 2.5 times the mass of the Sun), no known repulsive force inside a star can push back hard enough to prevent gravity from completely collapsing the core into a black hole. From the perspective of the collapsing star, the core compacts into a mathematical point with virtually zero volume, where it is said to have infinite density. This is called a singularity. Where this happens, it would require a velocity greater than the speed of light to escape the object's gravity. Since no object can reach a speed faster than light, no matter or radiation can escape. Anything, including light, that passes within the boundary of the black hole – called the "event horizon" – is trapped forever." (http://hubblesite.org/reference_desk/faq/answer.php.id=56&cat=exotic, accessed in June 2015)

Today's engineers continue to regard metaphor as a *tool* or *device* that aids in accomplishing a task. The idea that metaphor can be employed to help them *do*, *obtain* or *solve* something is, for instance, inherent in *human-computer interaction* (HCI) research. Blackwell (2006) analyzed the reification of metaphor as a *design tool* and placed the initiative among HCI textbook writers who encouraged professional designers to favor metaphors if they wanted to increase the initial familiarity between users and their computer applications. Moreover, commercial software design guidelines have been equally direct in promoting metaphor as a necessary 'cognitive bridge' for users to understand the features of various applications: "Familiar metaphors provide a direct and intuitive interface for user tasks. By allowing users to transfer their knowledge and experience, metaphors make it easier to predict and learn the behaviors of software-based representations. […] Metaphors support user recognition rather than recollection. Users remember a meaning associated with a familiar object more easily than they remember the name of a particular command." (Microsoft Corporation, 2001). The tremendous success of the 'desktop' and the 'windows' metaphor has increased the popularity of metaphor among corporate HCI researchers who built even more overtly metaphorical interfaces, such as General Magic's *Magic Cup* (1994) and Microsoft's *Bob* (1995). In his complex analysis of various attitudes toward metaphor among HCI researchers, Blackwell reported on some tendency among the researchers and practitioners attending a 2003 workshop to refer to the *user* as "a cognitive design resource, the recipient of a mental model constructed by the metaphor designer" and retained their dilemma on "whether the designer or user should "own" the UI[4] metaphor" (2006: 513). In this respect, the author opined that UI metaphor was a theory constructed as a result of commercial success: "Whatever the ambitions of HCI researchers, it seems most likely that the thought-space under the umbrella of "metaphor" is owned and controlled, in the same way as any other property of Western society, by the corporations operating our economic and legal systems. When a company designs a "mental model" as an engineering surrogate for an actual person, this company is really *designing the user* to be a better customer for their products" (2006: 513, emphasis in original).

Ignatow's metaphoric content analysis of the jargon of American high technology industry from the 1960s to the 1990s has revealed an increased incidence of *profane metaphors*[5] as compared to the jargons of

[4] UI stands for *user interface.*

[5] In order to offer some linguistic evidence and help our readers ascertain the degree of 'irreverence' displayed by the source domains of such metaphorical expressions,

other occupations, which he finds inexplicable in terms of contemporary Durkheimian cultural analysis. Nevertheless, the author argues that the proliferation of profane symbolism in high technology industry is indicative of the power of metaphors to "buttress a moral worldview that makes technological innovations meaningful to their creators" (2003: 1). At the same time he offers a plausible account of their presence in the occupational lexicons selected for the extraction of metaphoric entries. Firstly, it is suggested that this category of metaphors are rooted in the pragmatics of professional communication where high tech workers need to coordinate their activities across various domains of expertise, exchange complex, abstract and unfamiliar ideas, and avoid long explanatory routes by resorting to simple images and embodied experiences. Secondly, their presence is indicative of an age-related phenomenon in IT and computer industry, namely that these fields are professionally "populated" by young workers who "may feel less constrained by standards of tastefulness than do older workers, and […] may be more prone to create playful, humorous and ironic neologisms" (2003: 13). Thirdly, this category of metaphors cannot

---

we shall reproduce below the passage in which Ignatow *deliberately knitted* together a multitude of metaphorical terms. To facilitate the understanding of the artificially created text, we extracted the significance of every entry from his appendix and bracketed it in italic type. "In the world of high technology, on any given day, an "idea hamster" [*people who always seem to have their idea generators running*] may battle the "marketing slime" [*marketing people*]. A "seagull manager" [*a manager who flies in, makes a lot of noise, shits all over everything, then leaves*] may have to "kill your babies" [*term used in a production situation in which a piece of work that one is particularly fond of must be removed*] to get a project off of "life support" [*the condition of a business or project that is fighting for its life in the boardroom or the marketplace*]. "Paint monkeys" [*a person with a less than glamorous entry level computer graphics job*] may "spam" [*flood usenet newsgroups and email boxes with commercial ads*] or "facemail" [*technologically backward means of communication, clearly inferior to voice mail or e-mail; involves actually walking to someone's office and speaking to him or her face to face*] the designosaurs" [*a species, nearing extinction, of designers who refuse to use computers*] who are also "stress puppies" [*a person who seems to thrive on being stressed out and whiny*], especially on "salmon day" [*when you spend the entire day swimming upstream only to get screwed in the end*] or when "salescritters" [*computer salespeople*] are around. Programmers in companies on the "bleeding edge" [*general industry usage, synonym for "cutting edge", with an added implication of the pioneer's vulnerability*] may want to "touch skin" [*a meeting arranged to counter the austerity of communicating in cyberspace*] in "meatspace" [slang term for *the physical world as opposed to the virtual*] to talk about "eyeballs" [media slang for *viewing audience*], "dogfood" [*software code not fit for public consumption but good enough for internal purposes, very unrefined and buggy, but containing the basic nutrients*] , "dog bones" [*the bone-shaped holographic stickers used to seal compact disk boxes*], "weasel users" [*computer nerd*], "cobwebs" [*a dead webpage*], "router droppings" *[the inclusions added to e-mail messages by routers … cryptic and foul looking*], and "link rot" *[obsolete website links*] (2003: 12-13).

be entirely deprived of their emotive force or aesthetic value. Ignatow shares the conviction that less conventional work spaces have a positive impact on productivity, collaboration and inspiration and believes that this category of metaphors is summoned to *compensate for* the lack of a stimulating environment and eventually epitomize our human *biophilia*. He made this point cogently when he wrote: "Perhaps this style of jargon serves as an aesthetic stimulant in environments – computer labs, offices, cubicles, cyberspace – that are conspicuously artificial and lacking in sources of visceral engaging. Profane symbols are created and selected for because they render the otherwise sterile products of high technology more aesthetically and viscerally engaging" (2003: 14). Fourthly, beyond the positive pragmatic implications of the use of metaphorical expressions in professional or semi-professional settings, there is also an intense emotional commitment to *technological artifacts* which results in symbolic preferences. In this respect, the author notices that complex or outstanding technological artifacts such as computers, programs or internet systems are seldom symbolized as *profane,* while non-technological objects or those that threaten or hinder technological progress are construed as *profane.* This detected preference enabled him to make an even finer observation, namely that "[i]n high technology industry, the metaphorical structure of the relationship of high technology to everything else is not *sacred: profane*" but more like "*benign: profane,* because ideas of sacredness are ambiguous or not consensual" (2003: 15). Thus, while the more 'favorable' term *cyberspace* refers to the internet environment, the more 'organic' term *meatspace* points to the physical world where human beings depend on their bodies.

Conclusions

Apparently, there is no difference between a child who calls a bird's nest a *house* and today's physicists who invite us to picture our universe as a *membrane* floating within a higher dimensional space (Arkani-Hamed, Dimopopulos and Dvali, 2002). No matter how *spontaneous* or *deliberate* their semasiological decisions might be, both laypeople and professionals embrace metaphors to deliver themselves from the power of *the inexpressible*. As a *tool* devised by human beings for the use of other human beings, *metaphor* fulfils three major functions:

1) it is an *epistemic* device intended to provide satisfactory explanations;

2) it is an *inferential* device that unveils new aspects of the phenomena under investigation;

3) it is a theory-construction device.

Most *metaphor-driven* professional experiences reported by either humanities scholars or science-and-technology professionals seem to suggest that metaphor belongs to the category of 'technology'. To put it differently, while intrinsically blending conceptual and linguistic resources, *metaphor* is some 'primary technology' that *Homo sapiens* and *Homo faber* must have resorted to while becoming *Homo loquens*. To a certain extent, the term *Homo loquens* trumps the other two because the very act of defining something is a move within language. However, it is much more profitable to consider that *reasoning*, *tool making* and *language* were bound together in an evolutionary nexus and, as recent paleoanthropological evidence seems to suggest, the beginnings of language were inevitably linked to the sociability of hominids and the growth of collective tool production.

References

Arkani-Hamed, Nima, Dimopopulos, Sava and Dvali, Georgi (2002), "The Universe's Unseen Dimensions", in *Scientific American*, 12(2), pp. 66-73.

Bailer-Jones, Daniela M. (2002), "Models, Metaphors and Analogies", in Machamer, Peter, and Silberstein, Michael (Eds.), *The Blackwell Guide to the Philosophy of Science*, Blackwell Publishers, Malden, MA, pp.108-127.

Blackwell, Allan F. (2006), "The Reification of Metaphor as a Design Tool", in *ACM Transactions on Computer-Human Interaction*, 13(4), December, pp. 490-530.

Boyd, Richard (1993), "Metaphor and theory Change: what is 'metaphor' a metaphor for?", in Ortony, Andrew (Ed.), *Metaphor and Thought* (2nd edition), Cambridge University Press, Cambridge, pp. 482-533.

Brown, Theodore L. (2003), *Making Truth: Metaphor in Science*, University of Illinois Press, Urbana IL.

Cameron, Lynne and Maslen, Robert (2010), *Metaphor Analysis: Research Practice in Applied Linguistics, Social Sciences and the Humanities*, Equinox Publishing Ltd., London.

Davis, Michael (1996), "Defining "Engineer": How To Do It and What It Matters", in *Journal of Engineering Education*, 85, April, pp. 97-101.

Giles, Timothy D. (2008), *Motives for Metaphor in Scientific and Technical Communication*, Baywood Publishing Company, Inc., Amityville, New York.

Ignatow, Gabriel (2003), ""Idea hamsters" on the "bleeding edge": profane metaphors in high technology jargon", in *Poetics*, 31, pp.1-22.

Knudsen, Susanne (2003), "Scientific metaphors going public", in *Journal of Pragmatics*, 35, pp.1247-1263.

Kockleman, Paul (2005), "The semiotic stance", in *Semiotica*, 157 (1/4), pp. 233-304.

Kövecses, Zoltán (2010), *Metaphor*, 2nd edition, Oxford University Press, Oxford–New York.

Lakoff, George and Johnson, Mark (1980), "The Metaphorical Structure of the Human Conceptual System", in *Cognitive Science*, 4, pp.195-208.

Martin, Janet and Harré, Rom (1982), "Metaphor in Science", in Miall, D. S., (Ed.), *Metaphor: Problems and Perspectives*, The Harvester Press, Sussex, pp. 89-105.

Núñez, Rafael (2008), "Conceptual Metaphor, Human Cognition, and the Nature of Mathematics", in Raymond W. Gibbs, Jr. (Ed.), *The Cambridge Handbook of Metaphor and Thought*, Cambridge University Press, Cambridge, pp. 339-362.

Ortony, Andrew (1975), "Why metaphors are necessary and not just nice", in *Educational Theory*, 25(1), pp. 45-53.

Ruiz de Mendoza Ibáñez, Francisco José and Pérez Hernández, Lorena (2011), "The Contemporary Theory of Metaphor: Myths, Developments and Challenges", in *Metaphor and Symbol*, 26, pp.161-185.

Thibodeau, Paul H. and Boroditsky, Lera (2011), "Metaphors We Think With: The Role of Metaphor in Reasoning", in *PLoS ONE*, 6(2), e16782, DOI: 10.1371/journal.pone.0016782.

Waldron, S. (2013), "'Black holes': escaping the void", in *Jourrnal of Analytical Psychology*, 58(1), pp. 99-117.