

## A Metaphoric Nexus of Terms in Neuroanatomy

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### Abstract

This article offers an overview on the usage of technological metaphors in medicine, and in Neuroanatomy in particular. Exploring major technological metaphors surrounding human brain and nervous system, the paper aims at illustrating the cognitive functions these metaphors have in communicating clinical phenomena and pathologies. The neuroanatomical section in the “Gray’s Anatomy” – the clinical Bible of medicine – has served a major reference point for the analysis of metaphors.

**Key words:** metaphor, cognitive value, medicine, technology, Neuroanatomy.

### Introduction

In recent years metaphors have received increasing attention for much of the discourse in medicine and healthcare hinges on metaphors. Medicine often resorts to metaphor in discussion of processes, phenomena, or discoveries which are conceptually complicated and sometimes difficult for recognition or comprehension. Lakoff and Johnson claim that metaphor “... is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature” (Lakoff and Johnson 2003). “The essence of metaphor”, they write, “is understanding and experiencing one kind of thing in terms of another” (ibid.). In their scholarly work “Models, Metaphors and the Hermeneutics of Designing”, Snodgrass and Coyne (1991) highlight that the word *metaphor* originates from Greek *metaphora* having the meaning *transfer*. In continuation, they state that metaphor can consequently be considered “the transfer of one concept to another” (ibid.:7). When saying *transfer* one may assume that it implies *movement of something between two domains*. According to Way (1994), the *transfer* can most probably entail *shift of meaning*. Kittay (1987) offers a different view in accordance with which transfer involves a “displacement of signs”.

### The Technology Metaphor in Neuroanatomy

Long before the emergence of the approaches mentioned above, there were two strands of discussion whenever the usage of metaphor was concerned. One of these strands was organised around the nature of the conceptual theory of metaphor and the other was around the conventional views on metaphor dominated by philosophical concerns about the rhetoric value of metaphor and the nature of truth and science. Classical rhetoric had originally been an art highly respected in which metaphor played a key role (Vickers 1970:20-21). Later, however, “ars rhetorica” was gradually associated with obscurity. Aristotle, for instance, described metaphor as “giving something a name that belongs to something else” (Mooij 1976:18; Way 1994:14). In his “*Poetics*” Aristotle

gives a definition which appears to form part of his discussion of poetic style: "Metaphor is the transference of a term from one thing to another: whether from genus to species, species to genus, species to species, or by analogy" (Halliwell 1987:55). Another statement on metaphor made by Aristotle appears in the "*Topica*" resembling more a warning against the usage of metaphor, since it claims that metaphor should not be used in definitions, for "a metaphorical expression is always obscure" (Ross 1958:116). Not elaborating on the cognitive significance of metaphor, Aristotle considers metaphor mainly fit for ornamental or decorative purposes.

Furthermore, in the light of such developments, metaphor was seen as a deceitful device and thus unsuitable for scientific discourse. This view, i.e., the view on rhetoric and figurative language as a deceptive language, is clearly illustrated in the work "An Essay Concerning Human Understanding" by John Locke (2007:189) in the following lines: "...language is often abused by figurative speech. But yet 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; and so indeed are perfect cheats; and therefore, however laudable or allowable oratory may render them in harangues and popular addresses, they are certainly, in all discourses that pretend to inform or instruct, wholly to be avoided; and where truth and knowledge are concerned, cannot but be thought a great fault, either of the language or person that makes use of them...."

In the light of vast array of vehement attacks on the suitability of metaphor for scientific discourse, its cognitive value was not extensively elaborated upon until the 1930s. It was in 1936 that Richards first presented the cognitive theory of metaphor. In "The Philosophy of Rhetoric" (1936:92) he argues that metaphor should be regarded as a constituting element of language and never as an embellishment. In particular, his statement on the usage of metaphor goes as follows: "Even in the rigid language of the settled sciences we do not eliminate or prevent it [i.e. metaphor] without great difficulty. In the semi-technicalised subjects, in aesthetics, politics, sociology, ethics, psychology, theory of language and so on, our constant chief difficulty is to discover how we are using it and how our supposedly fixed words are shifting their senses. In philosophy, above all, we can take no step safely without an unrelaxing awareness of the metaphors we, and our audience, may be employing; and though we may pretend to eschew them, we can attempt to do so only by detecting them. And this is the more true, the more severe and abstract than philosophy is. As it grows more abstract, we think increasingly by means of metaphors that we profess not to be relying on."

Historically, the cognitive research on the application of metaphor can also be traced back to the work "Models and Metaphors: Studies in Language and Philosophy" (1962) by Max Black. Prior theories on metaphor had been premised on the hypothesis that metaphor was mainly an aesthetic device and therefore, not fit for scientific discourse. Black introduces the interactional view of metaphor according to which the meaning of a metaphor is the result of the "interaction between copresent thoughts". In order to comprehend the meaning of the metaphor within a text, the two "thoughts" have to be "con-

nected", in other words, the different meanings of the two subjects within a metaphor shall be in an interaction with each other and the features of a meaning of one subject can thus be projected in the meaning of the other subject. Ever since the views propped by Richards and Black, many other scholars have highly underscored the cognitive value metaphor entails. For instance, Lakoff and Johnson (2003) make an important claim in their "Metaphors We Live By" by stating that metaphor, as cited above, is not just a matter of language, but that our ordinary conceptual system is largely metaphorical as well. The authors use such phrases as "conventional" metaphors, "everyday" use in order to support their argument that metaphor forms a central component of human cognitive system. For instance, an illustration may be the claim "conventional metaphor [...] pervades our conceptual system" (Lakoff and Johnson 2003:196). Gibbs (1994:122) argues as follows: "Metaphors and other tropes not only serve as the foundation for much everyday thinking, they also continue scholarly theory and practice in a variety of disciplines, as well as providing much of the foundation for our understanding of culture." It is noteworthy, that there are many examples on the usage of metaphor in the history of science which led to major scientific discoveries. In particular, the medicine, as a scientific domain, has been replete with metaphors ever since the Renaissance – ever since the times of Andreas Vesalius and William Harvey.

Andreas Vesalius (1514-1564) was the leading anatomist of the High Renaissance. In his masterpiece "De humani corporis fabrica" (1999), Vesalius refers to human body employing mechanical or technological metaphors which facilitate the comprehension of human anatomy and anatomical specificities. It should, however, be mentioned that the word "mechanical" here is termed in the light of technology within the Renaissance period. Some examples illustrate the role of bony structures, going as follows: "Ossicles in the ear resemble an anvil and a hammer", "The skull is a fortification, a protecting rampart defending the brain; it is a helmet, an immovable wall", "The middle of the lower end of the humerus, where can be seen a depression with swellings on either side, the whole resembling the sheave of a pulley around which the ropes turn."

A tribute shall also be paid to the work of William Harvey (1578-1657) who, drawing from above mentioned leading Renaissance figure, develops the notion of human body as a machine or mechanic structure. Harvey is best known for his work titled "The Motion of the Heart" which was published in 1628 and characterized this human organ – the heart – as a sort of mechanical device. The publication of this work led to an important medical discovery in the 17<sup>th</sup> century. The essence of this discovery was that a finite amount of blood circulated on a continuous basis throughout the body of both humans and animals. The most captivating aspect of this statement is the usage of the metaphor of blood flowing in a circle which enabled Harvey to explain how the blood flowed through the body. The term "blood circulation" which is still widely used in medicine, reminds of the circle metaphor which was first introduced by Harvey back in 1628 (Rothbart 1984:611).

Currently, the usage of metaphors in science is viewed as an integral part of comprehension and cognition. For instance, Holton (1995:268) argues as follows: "In the work of the active scientist there are not merely occasions for using metaphor, but necessities for doing so [...] the necessity built into the process of scientific rationality itself, an epis-

temological necessity that covers the search for and usage of metaphors. It is simply the limit of induction. Where logic fails, analogic continues.”

Creative thinking and metaphoric expressions are often necessary in order to conceptualize in the real world what goes far beyond the knowledge human conceptual system does possess. In furtherance, Gibbs (1994:125) states that metaphors allow people to communicate complex configurations of information that better capture the rich, continuous nature of experience. Scott Montgomery (Montgomery 1996:134) claims that metaphor is as essential to communication among professionals, even at the highest level of research, as it is to communication with patients or in popular discussion. He also argues that modern Western medical thinking and research are organised around, *inter alia*, bioinformationist metaphors. These metaphors aim at portraying the human body as a communications system which operates in terms of “transmitters”, “networks”, “encoding”, “patterns”, “interactive units”, etc.

Since the present article aims at studying the metaphors which have been incorporated from the domain of technology into Neuroanatomy, it should be noted, that communication systems are also viewed as part of technology. In this sense Neuroanatomy can safely be characterised as a medical domain employing technological metaphors for purposes of referring to medical processes, cell and neuron functions in the human nervous system. In the words of Banks and Thompson (1996:99-126) “people are incorrigible users of metaphor in thinking about sickness and health and the workings of the human body.” Metaphors are considered to reframe complex issues and thus facilitate understanding and help provide meaning. In recent technological developments and innovations the need for new terms and expressions in Neuroanatomy is specifically obvious in order to render new notions of knowledge which are yet unknown. Since medicine is a scientific field where new developments and innovations are registered on a daily basis, it also keeps pace with the ever-changing global tendencies and incorporates new terms and expressions. The creation of computers and the communication systems, for instance, have structured a number of important conceptual metaphors used in medicine in general, and in Neuroanatomy in particular. In an extensive corpus of texts in Neuroanatomy many communication systems metaphors are frequently used for the description of the human brain, its structure and certain cerebral functions. The following examples are from the section on Neuroanatomy in *Gray's Anatomy* (2005):

*The brain is a highly vascular organ, its profuse blood supply characterised by a densely branching arterial network.*

(Gray's Anatomy 2005:295)

*It demands about 15% of the cardiac output and utilizes 25% of the total oxygen consumption of the body.*

(Gray's Anatomy 2005:295)

*Neurons encode information; conduct it, sometimes over considerable distances and then transmit it to other neurons or to non-neural tissues.*

(Gray's Anatomy 2005:295)

In technological systems, *output* is understood as the power, energy, or other results supplied by a device or system and this specific meaning is shifted to neuroanatomical domain in order to describe the working required by the human cardiac system. Since the human brain is not a single isolated element in the body, yet composed of multiple interconnected nervous tissues, it forms a *network* and, as an event external to a nervous system, neurons act as agents in information *encryption and transmission*, which the brain modifies later in any manner.

Perhaps because Neuroanatomy involves fundamental notions on human brain and nervous system often in a way which is mysterious or challenging for comprehension, it often employs metaphors to describe these phenomena. In addition, the introduction of new kinds of machines, such as computers and other units of communications systems has led to the formation of new machine metaphors, which are specifically incorporated into the description of the functioning of the human nervous system. Recalling the interaction theory of the metaphor it becomes obvious that the features of the meaning of technological units are projected into the meaning of neuroanatomical processes. The following excerpts from the section on Neuroanatomy in *Gray's Anatomy* illustrate the usage of such metaphors:

*The human nervous system is the most complex product of biological evolution. The constantly **changing patterns** of activity of its billions of **interactive units** represent the fundamental physical basis of every aspect of human behaviour and experience.* (Gray's Anatomy 2005:227)

*The functional capabilities of the nervous system are a product of its vast population of **intercommunicating nerve cells** ....* (Gray's Anatomy 2005:227)

*Transmission of information to other cells is brought about when action potentials cause the release of specific neurotransmitter substances, stored in synaptic vesicles within the **presynaptic nerve terminal**.* (Gray's Anatomy 2005:228)

*The neurotransmitter binds to these, and depending upon the nature of the chemical and the receptor, either elicits an excitatory or inhibitory response, or may modulate intracellular second **messenger systems**.* (Gray's Anatomy 2005:228)

*They greatly outnumber sensory and motor neurons and confer on the nervous system its prodigious capacity to **analyse, integrate and store information**.* (Gray's Anatomy 2005:228)

When it comes to alteration in functions or structure of neurons, certain communication systems-related metaphors are also employed in order to describe the nature of this process as illustrated in the following examples:

*[...] cortical neurons undergo a profound epigenetic reprogramming in response to dysfunctional D2 autoreceptor signaling leading to altered DA levels, a process that may underlie a number of neuropsychiatric disorders.*

(Brami-Cherrier et.al. 2014)

*They waited a while before using their device over a human head, fearing that the TMS pulse might magnetically erase the hard-drive of the human brain.*

(George et.al. 2002)

Once again referring to the interaction theory of metaphor, it should be highlighted that the interaction between the terminology of technology and Neuroanatomy is also noteworthy in the sense that computers, for instance, can also be described through metaphors generated from this domain since computers are units with *memories*, and they can be infected by *viruses* and are administered by *antiviruses*, respectively.

### Conclusion

Having regard to the aforementioned, it can be concluded that the technology metaphor helps to gain better understanding of various medical processes in Neuroanatomy. The usage of the technology metaphor also facilitates cognition with regard to description of certain aspects of nervous system and brain. In this case the technology metaphor is more than a linguistic phenomenon. Medical images of human nervous system and the brain are communicated through metaphors, thus solving the issue of introduction of a new term in Neuroanatomy. Metaphors thus serve as cognitive devices and aids in explaining scientific discoveries memory retention of which may be impeded by the lack of necessary vocabulary items. In addition, such explanation implies that they should be scientifically precise and unambiguous among larger audiences since these discoveries become the possession of the humanity only when they become explicable and easier for recognition. Metaphors thus lead to a better understanding or comprehension of the novel and complex notions or discoveries. Metaphors which are related to analogous items familiar to the public facilitate recognition when the clinical counterpart of these items is encountered in a medical or clinical practice. Hence, metaphor is thus seen as an indispensable cognitive instrument and communicative tool of language in terms of which medical concepts are structured, and sometimes even medical theories are formulated and clinical signs and pathology accurately translated into the scientific discourse.

### References:

1. Banks, W.P.; Thompson, S.C. (1996) *The Mental Image of the Human Body: Implications of Physiological Mental Models of Our Understanding of Health and Illness.* // Metaphor: implications and applications. / Ed. by J.S. Mio, A.N. Katz. Mahwah, New Jersey: Lawrence Erlbaum Associates.

2. Black, M. (1962) *Models and Metaphors: Studies in Language and Philosophy*. Ithaca: Cornell University Press.
3. Brami-Cherrier, K., et.al. (2014) *Epigenetic Reprogramming of Cortical Neurons through Alteration of Dopaminergic Circuits*. Available at: <<http://www.ncbi.nlm.nih.gov/pubmed/25023144>> [Accessed September 2014].
4. George, M.S., et.al. (2002) *Mechanisms and State of the Art of Transcranial Magnetic Stimulation*. Available at: <<http://www.ncbi.nlm.nih.gov/pubmed/12468991>> [Accessed September 2014].
5. Gibbs, R.W. (1994) *The Poetics of Mind: Figurative Thought, Language, and Understanding*. Cambridge: CUP.
6. Harvey, W. (1964) *The Anatomical Lectures of William Harvey*. / Tr. by G. Whitteridge. Edinburgh: Livingstone.
7. Halliwell, S. (1987) *The Poetics of Aristotle, Translation and Commentary*. London: Duckworth.
8. Holton, G. (1995) *Metaphors on Science and Education*. // From a Metaphorical Point of View: A Multidisciplinary Approach to the Cognitive Content of Metaphor. / Ed. by Z. Radman. New York: de Gruyter.
9. Kittay, E.F. (1987) *Metaphor: Its Cognitive Force and Linguistic Structure*. Oxford: OUP.
10. Lakoff, G., Johnson, M. (2003) *Metaphors We Live by*. London: The University of Chicago Press.
11. Locke, J. (2007) *An Essay Concerning Human Understanding. Book III: Words*. Available at: <<http://www.earlymoderntexts.com/pdf/lockess3.pdf>> [Accessed September 2014].
12. Montgomery, S.L. (1996) *Illness and Image: on the Contents of Biomedical Discourse*. // The Scientific Voice. / Ed. by S.L. Montgomery. New York and London: Guilford Press.
13. Mooij, J.J.A. (1976) *A Study of Metaphor*. Amsterdam: North-Holland Publication.
14. Richards, I.A. (1936) *The Philosophy of Rhetoric*. Oxford: OUP.
15. Ross, W.D. (1958) (Ed.) *Aristotelis, Topica et Sophistici Elenchi*. Oxford: OUP.
16. Rothbart, D. (1984) *The Semantic of Metaphor and the Structure of Science*. Philosophy of Science 51.
17. Snodgrass, A.; Coyne, R. (1991) *Models, Metaphors and the Hermeneutics of designing*. Working Paper, Faculty of Architecture, University of Sydney.
18. Standring, S. (2005) *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 39<sup>th</sup> edition, ELSEVIER: Churchill Livingstone.
19. Way, E.C. (1994) *Knowledge Representation and Metaphor, Intellect*. Oxford: OUP.
20. Vesalius, A. (1999) *On the Fabric of the Human Body. Book II: The Ligaments and Muscles*. / Tr. by W.F. Richardson in collaboration with J.B. Carman. Available at: <<http://books.google.am/>> [Accessed September 2014].
21. Vickers, B. (1970) *Classical Rhetoric in English Poetry*. London: Macmillan and Co.

### **Տեխնոլոգիական փոխաբերույթը նեյրոանատոմիայում**

Սույն հոդվածում քննության է առնվում տեխնալոգիայի ոլորտի փոխաբերույթների կիրառությունը բժշկագիտության՝ մասնավորապես նեյրոանատոմիայի բնագավառում: Հոդվածի շրջանակներում փորձ է արվում ներկայացնել փոխաբերույթի ճանաչողական դերը նեյրոանատոմիայի ոլորտում կլինիկական երևույթների և ախտաբանական գործընթացների նկարագրության գործում: Վերլուծության ենթարկվող լեզվական նյութը գլխավորապես վերցված է կլինիկական գործունեության համար նախատեսված “Gray’s Anatomy”-ի նեյրոանատոմիային նվիրված բաժնից:

### **Метафорический вексус терминов в нейроанатомии**

В данной статье анализируется использование метафор в медицине, в частности – использование технологических метафор в области нейроанатомии. Рассматривается вопрос о когнитивной роли метафорической номинации в интерпретации клинических явлений и патологий. Раздел, посвященный нейроанатомии из клинической библии медицины “Анатомия Грея” послужил материалом для анализа.