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## Verbal and pictorial metaphors in the theory of evolution

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## Verbal and pictorial metaphors in the theory of evolution

### Słowne i obrazowe metafory w teorii ewolucji

The aim of this paper is to investigate selected metaphors in Darwin's theory and their graphic representations.

**Słowa kluczowe:** metafora słowna, metafora obrazowa

**Key words:** metaphor in science, pictorial metaphor

### Introduction

The purpose of this article is to investigate pictorial metaphors deriving from metaphors originally used by Darwin in his book *On the Origin of Species*, with the initial reservation that we are not interested in graphics used to ridicule the theory of evolution but in the ones offered by its proponents for pedagogical purposes. We believe that graphic representation of Darwin's verbal metaphors, though used to explain some aspects of the theory of evolution in an accessible way, makes the metaphors more literal and frequently leads to implications conflicting with assumptions of mainstream evolutionism. We also believe that an analysis of both verbal and pictorial metaphors of the same concepts is revealing as far as the nature of metaphorization is concerned. Methodologically, the analysis is based on the conceptual metaphor theory and follows standard procedure in that tradition.

The structure of the paper is as follows: first we discuss briefly the role of metaphor in science, then we present the most important conceptual metaphors found in Darwin's book *On the Origin of Species* and show their role in his theory. In section 3 we turn to a discussion of selected metaphors of evolution: verbal metaphors in Darwin's text and their pictorial representations found on the Internet. The paper is closed by observations and conclusions.

## 1. Metaphors in science

The significance of metaphor in scientific discourse was discussed by many scholars (for example: Kuhn 1993, Jaekel 2003, Fojt 2009, Zawisławska 2011, to name but a few). For the purposes of this paper, the most relevant is the distinction into theory-constitutive and exegetical metaphors (Boyd 1993) as well as the idea of opening of closed metaphors (Knudsen 2003).

According to Boyd (1993), we can distinguish two functions of metaphors in scientific discourse: theory-constitutive metaphors, which represent original scientific thought, and pedagogical or exegetical metaphors, which merely describe or explain existing knowledge. If we apply this distinction to Darwin's book we notice that his most important metaphors are theory-constitutive, which we demonstrate in the next section.

Knudsen (2003), on the basis of her study of metaphors describing the genetic code in specialist and non-specialist texts, observes that metaphorical concepts which were originally theory-constitutive, after years of clarification and application become "closed", that is they are no longer considered truly metaphorical by scientists. At the same time, in non-scientific texts, these closed metaphors become "opened", that is marked as metaphors through quotation mark or by explanation. Knudsen concludes that "despite the subsequent 'closing' of the metaphors in the scientific discourse, they still remain active and open in the involved scientists' minds, when the latter are engaged in producing non-specialist texts" (2003:1254). We believe that graphic representations of some aspects of evolutionism constitute vivid cases of opening of well-established metaphors.

## 2. Metaphors in Darwin's work

As I demonstrate elsewhere (Drogosz 2008, 2009, 2010, 2011, 2012a,b), a coherent system of conceptual metaphors plays a significant role in Darwin's theory<sup>1</sup>. It is through metaphorical expressions and analogies that he tried to precipitate his theory in language and make it understood both by fellow naturalists and the general readership. Let us have a short overview of the most important metaphors and their function in the theory.

Darwin's intention was to propose a mechanism that could explain the diversity of the natural world and the origin of natural species without resorting to supernatural forces, specifically to the concept of God. The basic line of argument is that as more organisms are born than could possibly survive, those that do survive

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<sup>1</sup> The use of metaphor in *The Origin of Species* was studied, for example, by Young (1985), Beer (1983), Al-Zahrani (2008).

have to display some advantage. The process of survival of those that are somehow better adapted to the environment is called the natural selection. Personification of natural selection as a powerful agent deciding between survival and extinction is one of the key metaphors. Because all organisms want to survive while only few can, the relationship between them is described in terms of struggle. We have then the well-known concept of the struggle for existence. At the same time Darwin proposed that in the course of time one species can become differentiated through accumulated changes (changes are thus conceptualized as physical substance that grows in amount) into many different species (that is how new species appear). This process of evolutionary change (accumulation of small changes leading to new varieties and later to new species) is described in terms of movement in space, a journey. Finally, related species are conceptualized as family members and their relationships in time described in terms of a genealogical tree. Such a tree diagram is the only picture we find in the book.

All these metaphors can be safely considered theory-constitutive, when we look at them from the perspective of Darwin's book: he was using them to frame his views in language in a clear and convincing way, and they provide coherence to the whole argument. Then, throughout 150 years after the publication of the book, when evolutionism has grown to be the mainstream scientific theory in natural sciences, for several generations of scholars Darwin's metaphors had lost their metaphorical load and become almost literal expressions with specific reference, used analogically to other scientific concepts. However, when evolutionism is taught or explained to laymen, these expressions are "opened" to assume pedagogical function, they regain their metaphoricity, which is especially vivid when an attempt is made to show them graphically. Interestingly, some Darwinian metaphors but not the others lend themselves to graphic representations. While personification or struggle are vital for Darwin's theory, they are never visualized. On the other hand, conceptualizations of evolutionary change as a journey, affinities among organisms as a family and as a tree become frequently represented in graphic form<sup>2</sup>. Next section juxtaposes Darwin's verbal metaphors with typical graphic representations they receive.

### **3. Pictorial metaphors in the theory of evolution**

In this section we are going to discuss three Darwinian metaphors which become frequently visualized: family, tree and journey.

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<sup>2</sup> The idea that some tenets of evolutionism can be visualized was clear to Darwin himself. Although in his book we find only one picture (a tree diagram depicting diversification of forms and emergence of new varieties and species), its existence is significant. We return to this issue in the last part of the paper.

### 3.1. Family, genealogical tree, tree of life

The metaphors of family and tree are tightly interconnected in Darwin's argument. On the one hand, he conceptualizes older (often extinct) forms of organisms from which more recent forms evolved as 'parent species' and 'ancestors' while the affinities among them as a (genealogical) tree. Consider the following fragments of *The Origin*:

1. By the theory of natural selection all living species have been connected with the parent-species of each genus, by differences not greater than we see between the varieties of the same species at the present day; and these parent-species, now generally extinct, have in their turn been similarly connected with more ancient species; and so on backwards, always converging to the common ancestor of each great class.
2. The affinities of all the beings of the same class have sometimes been represented by a great tree.
3. (...) The limbs divided into great branches, and these into lesser and lesser branches, were themselves once, when the tree was small, budding twigs; and this connexion of the former and present buds by ramifying branches may well represent the classification of all extinct and living species in groups subordinate to groups.

The tree metaphor is the only one that was visualized by Darwin himself. In *The Origin* we find a schematic diagram, in a form similar to that in Fig. 1, in which the older (ancestral) forms of species are located at lower parts of the diagram and the more recent at its upper parts, the contemporary forms (F) occupying the topmost position. The appearance of new varieties or species is depicted as branching of nodes. Although Darwin's own picture is very schematic and intended to support a detailed description, elaborate pictures of trees illustrating this point of the theory are easily found and remembered from school handbooks, for instance trees showing evolution of humans beginning with early vertebrates, through mammals, primates with people on the topmost branches, or only primates, as in Fig. 2.

The choice of a tree as a graphic representation has far-reaching consequences for how this aspect of evolutionism is interpreted. In the first place, the vertical orientation of the tree has axiological implications: through the activation of the UP-DOWN schema, organisms at the bottom are seen not only as older and less complex, but also as more primitive and worse, while those at the top are not only more contemporary but also better. Thus trees depicting *Homo Sapiens* at the top of the tree humour our sense of superiority. Secondly, the branches of trees have an end point which may imply that contemporary forms are the final product of evolution. What is more, locating a particular species at an end-point of a branch creates an illusion that the purpose of evolution was to produce this species, an illusion particularly strong in the case of human "tree of life" (in Fig. 1 it is visible

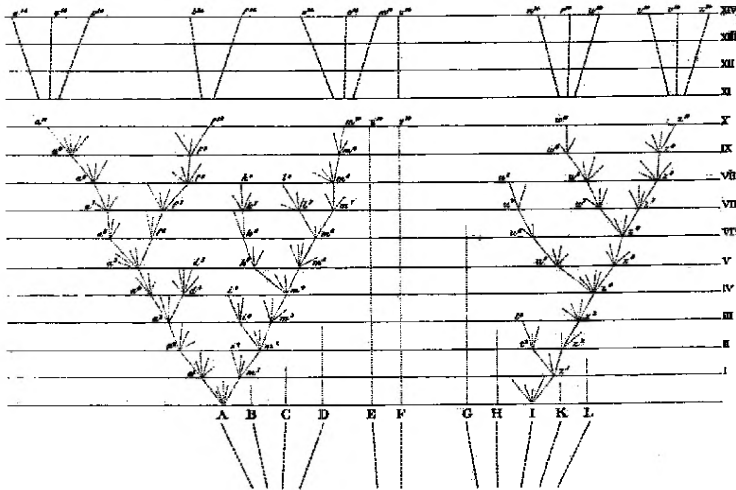


Fig. 1. Darwin's diagram presenting ancestral forms and descendant species<sup>3</sup>

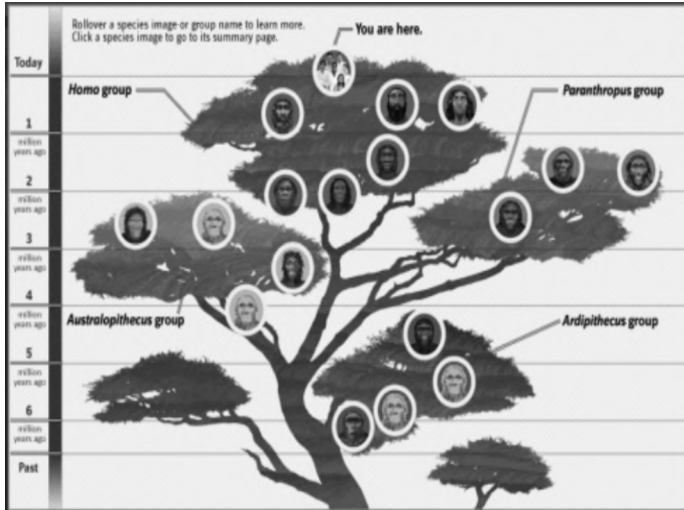


Fig. 2. Human genealogical tree<sup>4</sup>

<sup>3</sup> The source <[http://www.nature.com/nature/journal/v457/n7231/fig\\_tab/nature07889\\_F2.html](http://www.nature.com/nature/journal/v457/n7231/fig_tab/nature07889_F2.html)>.

<sup>4</sup> This representation of the human family tree is displayed at the David H. Koch Hall of Human Origins at the Smithsonian Natural History Museum. The source of this picture <<http://aninterestingdebate.tumblr.com/post/29794094624/the-complete-human-evolution-evidence-database>>.

in the form of a thicker “line of descent”). Some recent graphics try to overcome these difficulties presenting the tree of life in a horizontal orientation or in a circular shape; however, they appear more in specialist texts rather than in school handbooks.

### 3.2. The metaphor of journey

Darwin describes evolutionary change as a journey, elaborating the SOURCE-PATH-GOAL schema (cf. Drogosz 2012). This metaphor is found in abundance in *The Origin*, highlighting different aspects of change. The parent form of a species corresponds to the source, the transitory forms correspond to stages of this journey, while the end of a journey is mapped onto the new, better-fitted form.

4. Hence I look at individual differences, (...) as being the first step towards such slight varieties as are barely thought worth recording in works on natural history. And I look at varieties which are in any degree more distinct and permanent, as steps leading to more strongly marked and more permanent varieties; and at these latter, as leading to sub-species, and to species.
5. ‘I attribute the passage of a variety from a state in which it differs very slightly from a parent to one in which it differs more, to the action of natural selection in accumulating differences of structure in certain definite direction’.
6. By comparing the accounts given in old pigeon books treatises of carriers and tumblers with these breeds as now existing in Britain, India, and Persia, we can, I think, clearly trace the stages through which they have insensibly passed, and came to differ so greatly from the rock pigeon.

The journey metaphor has its entailments which surface when Darwin writes about a right direction of changes (7), when some modifications are referred to as diversions or deviations from the right direction (8), or when organisms showing features typical of earlier forms are said to revert in their journey (9):

7. ... natural selection will always tend to preserve all the individuals varying in the right direction
8. ... as natural selection acts by life and death-by the preservation of individuals with any favourable variation, and by the destruction of those with any unfavourable deviation of structure
9. ... these same species may occasionally revert to some of the characters of their ancient progenitors

Darwin’s conceptualization of gradual changes leading to the production of new species is perhaps the most frequently visualized metaphor of evolutionism, and is often referred to as “the march of evolution” or “march of progress”. Almost all such graphics present a series of individuals standing for distinct but related species in a position for movement forward, with older forms on the left, later forms on the right, and intermediate forms in between.

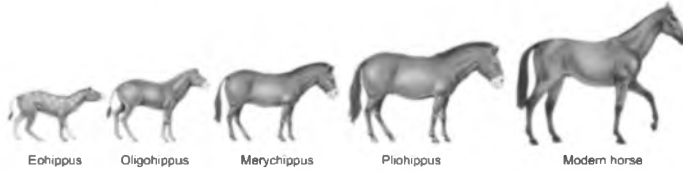


Fig. 3. A graphic representation of evolution of the horse<sup>5</sup>

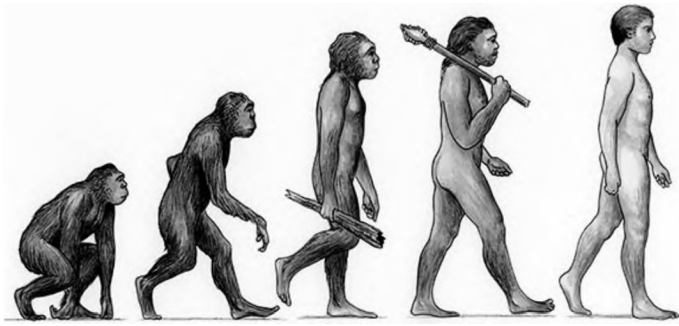


Fig. 3. Graphic representations of “the march of progress”<sup>6</sup>

Such graphics, constituting almost the hallmark of evolutionism, even more than Darwin’s metaphorical language, break the continuous process of evolutionary change into discrete stages, matching one of them with the SOURCE, the other with GOAL reinforcing in this way the illusion that evolution has an end. What is more, although Darwin’s language suggests progress (entailed by the metaphor of JOURNEY), in the pictures progress becomes far more conspicuous (hence the

<sup>5</sup> The source of the picture <<http://www.google.pl/imgres?q=evolution+of+the+horse&hl=pl&tbo=d&biw=1311&bih=588&tbn=isch&tbnid=Bv5pZSF3uEj3pM:&imgrefurl=https://www2.bc.edu/~evansjx/final/evolution.html&docid=zOYp-tBO3ijqeM&imgurl=https://www2.bc.edu/~evansjx/images/evolution.jpg&w=799&h=210&ei=WXvoUOmFIMv74QTOmYDYBQ&zoom=1&iact=rc&dur=421&sig=109595095083253104553&page=1&tbnh=72&tbnw=276&start=0&ndsp=22&ved=1t:429,r:3,s:0,i:93&tx=159&ty=33>>.

<sup>6</sup> The source of the picture <<http://www.google.pl/imgres?q=evolution+of+the+humans&hl=pl&tbo=d&biw=1311&bih=588&tbn=isch&tbnid=sEFYzC-WX36ZJM:&imgrefurl=http://www.smithsonian-mag.com/science-nature/The-Top-Ten-Daily-Consequences-of-Having-Evolved.html&docid=OTIjHp-lej7NNyM&imgurl=http://media.smithsonianmag.com/images/consequences-of-evolution-631.jpg&w=631&h=300&ei=gHzoUIz3K8aE4ATDm4G4Ag&zoom=1&iact=hc&vpx=559&vpy=320&dur=1515&hovh=155&hovw=326&tx=170&ty=112&sig=109595095083253104553&page=1&tbnh=128&tbnw=253&start=0&ndsp=17&ved=1t:429,r:14,s:0,i:126>>.



name of these graphics “the march of progress”). In this way, understanding evolutionary change as progress seems to agree with common sense, in spite of the fact that evolutionary biologists are far from agreement on this issue (Rosslenbroich 2006).

#### 4. Observations and conclusions

Even this short presentation of Darwin’s verbal metaphors and their graphic representations warrants some observations and conclusions concerning pictorial metaphors in evolutionism.

1. An analysis of verbal and pictorial metaphors of evolution shows interesting transformation of function that metaphors can undergo. First we see theory-constitutive metaphors in *The Origin of Species*, then they become a conventional way of talking about evolution in scientific language losing much of their metaphorical reading, next their metaphoricity is re-opened for pedagogical purposes in popular texts, and finally, they become graphic metaphors.
2. Paradoxically, graphic representations make metaphors more literal. This is due to the nature of this modality: while language is arbitrary and the meaning is conventionally ascribed to expressions (that is why a **metaphoric** way of talking about evolution could become a **conventional** way of talking about evolution), pictures use perception which is not arbitrary (cf. Kennedy 2008:459) (when we see a tree it is a tree). This makes the source domain more salient than in the case of verbal metaphors. Consequently, when a verbal metaphor describes evolution **as if it were** a journey, a pictorial metaphor describes evolution **as** a journey. In graphic metaphors branches of a tree of life have physical ends and “march of progress” has visible source and goal.
3. Although Darwin used only one diagram in his book, it is significant for the conceptual metaphor theory: it supports the claim that metaphors are based on a general cognitive principle, although in his text verbal metaphors dominate, they are not the property of language alone; when framing his theory Darwin was thinking in pictorial metaphors as well as evidenced from his notes.
4. While verbal metaphors of evolution are chronologically earlier, not all of pictures are mere graphic reflections of linguistic expressions: the picture of the “march of progress” consistently presents figures of humans or horses moving from left to right: **LEFT IS EARLIER**. This pictorial metaphor is independent of language (there are no metaphorical expressions in which to the left means earlier). The direction comes from graphic tradition motivated by mathematical axis and Western tradition of writing (cf. Cienki, Muller 2008:492).
5. Even apparently dead metaphors retain the potential to be vital conceptually (cf. Lakoff and Turner 1989 who reject the concept of the dead metaphor).

6. Pictorial metaphors seem to be more powerful in affecting the wide public than verbal metaphors as they cross language and culture barriers (cf. Forceville 2008). They also show greater flexibility and creativity: once a metaphor is “opened” and exploited graphically, it becomes a source domain for conceptualization of ideas far from the area of biology.

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### **Streszczenie**

Celem artykułu jest analiza metafor słownych i obrazowych w teorii ewolucji. Na podstawie zaprezentowanych danych wykazano, iż metafora w nauce może pełnić rolę w tworzeniu teorii jak również w jej wyjaśnianiu (funkcja pedagogiczna). Metafory obrazowe ilustrujące założenia ewolucjonizmu stanowią cenny przykład pedagogicznego zastosowania metafory, jednocześnie prowadząc do zniekształceń lub uproszczeń w rozumieniu teorii poprzez zastosowanie odmiennego środka przekazu (obraz).