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"Evolutionary change is a journey" : from Darwin to Dawkins

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EVOLUTIONARY CHANGE IS A JOURNEY: FROM DARWIN TO DAWKINS

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Introduction

In this paper we want to investigate instantiations of the SOURCE-PATH-GOAL schema (elaborated by the JOURNEY metaphor) in selected texts on biological evolution. We want to address the following issues: Firstly, is there a difference between its original use in Charles Darwin's text and its contemporary manifestations? Secondly, what consequences for the theory can the presence of the journey metaphor have? Thirdly, what is the role of this metaphor in theory construction: Is it a theory-constitutive or exegetical metaphor? In order to answer these questions we carry out a careful examination of manifestations of this metaphor in Darwin's book *On the Origin of Species* and in texts written by Richard Dawkins. Our analysis is conducted within the Conceptual Metaphor Theory (CMT) as presented by George Lakoff and Mark Johnson [1980, 1999], and Zoltán Kövecses [2002]. While Darwin's language and metaphors have been investigated by many scholars [cf. for example Beer 2000; Ruse 2005; Young 1985], we believe that the CMT provides a useful tool for a systematic analysis of Darwin's metaphors, which has been demonstrated in other studies [e.g. Al-Zachrani 2008; Drogosz 2008, 2009, 2010, 2011, 2012 a, b, c].

The structure of the paper is as follows: We begin with a brief presentation of the distinction between constitutive and exegetical metaphors proposed by Richard Boyd [1993]. Then we investigate instantiations of the JOURNEY metaphor in Darwin's *Origin* and in *The Selfish Gene* and *The Blind Watchmaker* by Dawkins. The last part of the paper comprises observations and conclusions.

Before we embark on our analysis one comment is due. The fact that many metaphors can be identified in the theory of evolution should not be taken as an argument against its validity. As demonstrated by many studies [e.g. Boyd 1993; Kuhn 1993; Knudsen 2003; Fojt 2009; Zawisławska 2011], language of science is inevitably metaphorical and evolutionism is not different in that respect.

1. Metaphor in science

In his seminal paper, Boyd [1993] distinguished two fundamentally separate categories of scientific metaphors: pedagogical/exegetical metaphors and theory-constitutive metaphors. **Exegetical, or pedagogical, metaphors** “do not convey theoretical insights not otherwise expressible” but they “play a role in the teaching or explication of theories which already admit of entirely adequate non-metaphorical (or, at any rate, less metaphorical) formulations” [Boyd 1993: 485–486]. That is why they can be easily paraphrased. **Theory-constitutive metaphors**, on the other hand, are used “in expressing theoretical claims for which no adequate literal paraphrase is known” [Boyd 1993: 486]. Thus, paraphrase becomes the distinguishing feature between the two types. The utility of theory-constitutive metaphors “seems to lie largely in the fact that they provide a way to introduce terminology for features of the world whose existence seems probable, but many of whose fundamental properties have yet to be discovered. Theory-constitutive metaphors, in other words, represent one strategy for the accommodation of language to as yet undiscovered causal features of the world” [Boyd 1993: 489–490]. Although Boyd emphasizes the catachretic role of theory-constitutive metaphors, he also points out that they “encourage discovery of new features of the primary and secondary subjects, and new understanding of theoretically relevant respects of similarity, or analogy, between them” [Boyd 1993: 489].

In this paper we want to demonstrate why we believe that the conceptualization of evolutionary change as a journey is an example of theory-constitutive metaphor. We also believe that the analysis of the use of this metaphor in the text of its origin and over a hundred years later allows us to slightly modify Boyd’s description.

2. The JOURNEY metaphor and *The Origin of Species*

The SOURCE-PATH-GOAL (SPG) image-schema belongs to the most fundamental schemas, next to the CONTAINER, LINK, PART-WHOLE, CENTER-PERIPHERY, BALANCE and FORCE [cf. Johnson 1987; Lakoff 1987] that are at the heart of our conceptual system and help make sense of the world. Following Lakoff and Johnson [1999: 32–34], the SPG schema has the following elements or roles:

- 1) a trajector that moves,
- 2) a source location (the starting point),
- 3) a goal (an intended destination of the trajector),
- 4) a route from the source to the goal,
- 5) the actual trajectory of motion,
- 6) the position of the trajector at a given time,
- 7) the direction of the trajector at that time,
- 8) the actual final location of the trajector (which may or may not be the intended destination).

Let us now have a look at how (and why) the SPG schema has become part of the evolutionary theory by examining some of its manifestations in Darwin's book *On the Origin of Species* first published in 1859. We have to remember that Darwin's primary objective was to explain the great diversity of biological species all over the world without resorting to action of any deity or any supernatural force, that is to explain the origin of species. An inherent part of his explanation is the idea that species are not immutable, that they change over time, and that one species in the past could give rise, through many gradual changes, to many other species as we know them today. The concept of change (of a form of a species, habits, organs, etc.) is thus the essence of the theory of evolution. If we consider some of the examples of how Darwin writes about change, we cannot ignore the strong presence of the SPG schema in the conceptualization of these changes:

- (1) *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** [373]¹.*
- (2) *[...] but we see so many strange gradations in nature [...] that we ought to be extremely cautious in saying that any organ or instinct, or any whole being, could not have **arrived at its present state by many graduated steps** [585].*
- (3) *[...] in however distant and isolated parts of the world they are now found, they must **in the course of successive generations have passed** from some one part to the others [586].*
- (4) *Although in many cases it is most difficult to conjecture by what transitions an organ could have **arrived** at its present state [447].*

Even on the basis of these few examples we can clearly see the correspondences (Table 1):

¹ The examples come from the text of the first edition of Darwin's work published in: *Darwin. The Indelible Stamp*, ed. J.D. Watson, Philadelphia – London, Running Press 2005. Although there were more editions published within Darwin's lifetime which he revised, we believe that the first edition is the most reliable if we hope to get an insight into Darwin's original thought (though his alternations and comments in later editions are very revealing).

Table 1

Correspondences in the metaphor EVOLUTIONARY CHANGE IS A JOURNEY

The elements of the SPG schema/JOURNEY	Evolutionary change
A trajector that moves; traveller	a form of a species/a variety of species/an organ
A source location (the starting point); beginning of a journey	a state in which a variety differs very slightly from a parent; an earlier form of a species
A goal (an intended destination of the trajector)	a state in which a variety differs more; a later form of a species
A route from the source to the goal; a path	the successive generations
The position of the trajector at a given time; a stage of a journey	the form of a species or a variety at a certain moment of change
The direction of the trajector at that time; the direction of movement	from the past (earlier forms) to the future (later forms)
The actual final location of the trajector	the current form of a species or a variety, as we know it now

For better understanding, the metaphor EVOLUTIONARY CHANGE IS A JOURNEY can be graphically presented as in Figure 1, where the moving objects correspond to organic forms travelling (changing) from the past (earlier forms) towards the future (evolved, improved forms) passing some stages (intermediate forms) on the way (evolution of a species as a whole).

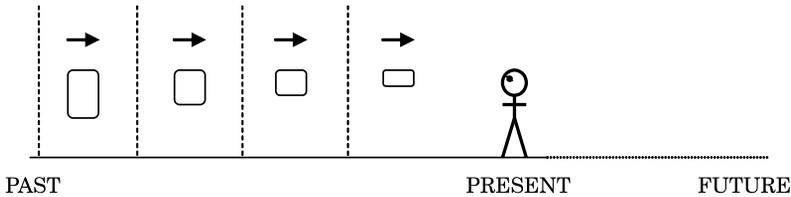


Fig. 1. EVOLUTIONARY CHANGE IS A JOURNEY

We believe that there two main reasons why Darwin, most probably not consciously, used the SPG schema (and its elaboration as a journey) to write about evolutionary change. One reason is the convention of talking about any change or process leading to a change as movement in space [cf. Lakoff and Johnson 1999: 183–184] available in the English language. In fact, it would take a conscious effort **not** to write about a change as movement. The other reason, equally powerful, comes from the graphic representation of species splitting into many varieties (and later distinct species) in the form of a tree diagram (the so-called “tree of life”)²

² The tree of life is tightly connected with another powerful metaphor used by Darwin, the family metaphor, which we do not discuss in this paper. For the details see Drogosz [2009].

that Darwin included in his book. From his notebooks we know that this idea of visualization was with him as early as 1837, so over twenty years before *The Origin of Species* was published, and there are good reasons to believe that it influenced the way Darwin thought and wrote about evolutionary change. Admittedly, the tree of life is intended to explain affinities among species, the concept that through accumulation of little differences new species can appear (as opposed to separate acts of creation), and the idea that only some species can survive in the struggle for life due to the action of natural selection. Yet it is in the diagram that the connection of a number of related species surfaces as a line (“line of descent”) inevitably activating the “route from source to goal” traversed by the trajectory of the SPG schema.

A careful analysis of further examples allows us to notice how the schematic mapping EVOLUTIONARY CHANGE IS A JOURNEY is elaborated by projecting the rich structure of the domain JOURNEY together with its inferences, and how the inferences about the domain JOURNEY become part and parcel of the language of evolutionary change. In the first place, from our knowledge of the domain of JOURNEY it follows that traversing a route to a current location assumes passing all previous locations on that route (cf. 5–7). Logically, we should necessarily expect to find transitory forms revealing earlier stages of evolution. What is more, displaying traits typical of earlier forms would then correspond to backward movement (cf. 8–10):

- (5) [...] *as by this theory innumerable **transitional forms** must have existed, why do we not find them embedded in countless numbers in the crust of the earth?* [437].
- (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* [364].
- (7) *Although in many cases it is most difficult to conjecture by what **transitions** an organ could have **arrived** at its present state* [447].
- (8) [...] *our domestic varieties, then run wild, gradually but certainly **revert** in character to their **original** stocks* [353].
- (9) [...] *these same species may occasionally **revert** to some of the characters of their ancient progenitors* [435].
- (10) *In both varieties and species **reversions** to long-lost characters occur* [592].

Secondly, the metaphor of the journey grants evolution a strong sense of direction and purpose (in spite of explicit statements to the opposite) as well as improvement, as in (cf. 11–13):

- (11) [...] *individual differences are the first step **towards** slight varieties, such as steps **leading to** more permanent varieties, these as **leading to** species* [373].
- (12) *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*** [373].
- (13) [...] *at each successive stage of modification and **improvement**, all the individuals of each variety will have descended from a single parent* [531].

Further inferences come from our knowledge concerning the nature of the route: the straight path leading to the goal is valued positively as the shortest way to the destination, while any departure from the straight path means delays. When projected to the logic of evolutionary change, it results in conceptualising forms not “directly leading” to a given form as departing from the desired path and thus of lesser value:

- (14) [...] *natural selection destroying any which **depart** from the proper type* [400].
- (15) *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* [488].
- (16) [...] *and any actually injurious **deviations** in their structure will always have been checked by natural selection* [488].

Finally, the metaphor of the journey joined with Darwin’s diagram of a tree facilitates our understanding of the process of differentiation of a species into distinct varieties or species:

- (17) [...] *the two groups are supposed to have gone on **diverging in different directions*** [411].
- (18) [...] *for at this early stage of descent they have not **diverged** in character from the common progenitor of the order, nearly so much as they subsequently **diverged*** [518].

As we can see from these examples (and there are many more in the *Origin*), the metaphor of JOURNEY was for Darwin much more than just a figure of speech. It not only provided the necessary vocabulary to precipitate his considerations in language in a comprehensible and convincing way but also became part of reasoning about evolutionary change: its progressive nature and directionality, sometimes at odds with other assumptions of the theory. At the same time it must be stated that Darwin was fairly restrained in his deployment of this metaphor. It is plain that he used it more out of necessity than for rhetorical flourish.

3. Richard Dawkins and the JOURNEY metaphor

Darwin turned out to be the first in the long line of scholars describing evolution in terms of a journey. Within the years after the publishing *On the Origin of Species* such descriptions became just a way of talking within evolutionism probably used without much reflection by generations of evolutionists. Darwin’s novel metaphor have turned into a conventional metaphor. At the same time this metaphor has undergone elaboration, especially in the hands of such writers as Richard Dawkins, who is very sensitive to the power of metaphor. In this section we are going to have a look at some of excerpts from two of his books *The Selfish Gene* [further: SG] and *The Blind Watchmaker* [further: BW]³.

³ For the sake of brevity only these two books were considered but the metaphor abounds in all writings by Dawkins. We also decided not to include texts written by other prominent evolutionists.

As to be expected, in Dawkins' texts we can identify the same mappings as we found in Darwin's *Origin*. For example, the mappings pairing the starting point with earlier forms, destination with later forms, and moving entity with a species/organ are well visible in the examples below:

- (19) *Octopus eyes are, in this respect, more 'sensibly' designed. They **have arrived at a similar endpoint**, from a very different **starting point*** [BW 95].
- (20) *Kangaroos and horses **arrived at different endpoints** in 'animal space', probably because of some accidental difference in their **starting points*** [BW 104].
- (21) [about the Tasmanian wolf] *To any dog-lover, the contemplation of this alternative approach to the dog design, this **evolutionary traveller along a parallel road** separated by 100 million years, this part-familiar yet part utterly alien other-worldly dog, is a moving experience* [BW 105].
- (22) *The species **has followed a particular path** through the labyrinth of all possibilities. There were 1,000 branch-points along the **path**, and at each one the survivors were the ones that happened to **take the turning that led to improved eyesight**. The wayside is littered with the dead bodies of the failures who **took the wrong turning** at each one of the 1,000 successive choice points. The eye that we know is the end-product of a sequence of 1,000 successful selective 'choices'* [BW 313].

Direction, progress, regression, and divergence as implications of this metaphor are also well represented.

There are, however, some differences to be noticed. In the first place, Dawkins is more explicit in his metaphorical language and frequently one passage makes use of several mappings, which is attested even by the examples above. Secondly, Dawkins puts more emphasis on the idea of gradual changes conceptualized as passing stages of a journey, which for him is more definitely than for Darwin a straight line with a strong emphasis on improvement:

- (23) *For instance, it leads us to expect that certain kinds of **transitions** between mating systems in evolutionary history will be probable, others improbable* [SG 302].
- (24) *It is thoroughly believable that every organ or apparatus that we actually see is the product of a **smooth trajectory** through animal space, a **trajectory** in which every **intermediate stage** assisted survival and reproduction* [BW 90–91].
- (25) *In genetic hyperspace, there is a **smooth trajectory connecting** free-swimming ancestral bony fish to flatfish lying on their side with twisted skulls* [BW 93].
- (26) *Anti-evolution propaganda is full of alleged examples of complex systems that '**could not possibly**' have passed through a gradual series of **intermediates*** [BW 86]⁴.

Examples of the metaphor EVOLUTIONARY CHANGE IS JOURNEY can be easily found in books by Stephen Jay Gould (1) or Daniel Dennett (2):

1. "If all **paths** through the equid bush **led** to the same Rome of modern Equus, or even if all major and prosperous **paths** – as measured by species range, diversity, or any conventional attribute of phyletic success – **moved** in the same general **direction**, then one might separate issues of species numbers, where the decline of equids through time cannot be denied, from the question of cladal **direction**, where the classic trend could still be asserted" [Gould 907].
2. "By taking tiny – the tiniest possible – **steps**, this process [natural selection] can gradually, over eons, **traverse** these huge distances" [Dennett 75].

⁴ Example (26) is particularly valuable, because it might suggest that the contention between evolutionists and anti-evolutionists concerns one of the inferences of the JOURNEY metaphor (traversing a route to a current location assumes passing all previous locations on that route) rather than empirical data.

- (27) [...] *we can quickly convince ourselves that there is a **graded series** of focusing quality, **each step in the series** being an **improvement** over the previous one* [BW 84].
- (28) [...] ***each step** in the series, however small (or large) **the step**, would be an optical **improvement*** [BW 85].
- (29) *Once such a crude proto-lens is there, there is a **continuously graded series of improvements**, thickening it and making it more transparent and less distorting, the trend culminating in what we would all recognize as a true lens* [BW 86].
- (30) *The **'improvement'**, moreover, is far from continuous. It is a fitful affair, stagnating or even sometimes going **'backwards'**, rather than moving solidly **'forwards'** **in the direction** suggested by the arms-race idea* [BW 181].

Thirdly, the EVOLUTION AS A JOURNEY metaphor receives new elaborations as well. Dawkins frequently writes about “developmental/evolutionary pathway” which suggests divorcing the metaphor of the journey from the tree of life:

- (31) *However, there must be genes for the capacity to be environmentally switched into either of the two developmental **pathways*** [SG 289].
- (32) *You might think that it would have been easy enough to reconstruct the evolutionary **pathway**, but it wasn't* [BW 64].
- (33) *The reason, which I shall come back to, is the astronomical number of possible biomorphs that a sufficiently long evolutionary **pathway** can offer, even when there are only nine genes varying* [BW 64].

Finally, a completely new development is the idea of a forced movement. Due to conceptualization of natural selection as a force absent in Darwin's text, organs are depicted as being pulled towards some destination:

- (34) *In other words, sexual selection is constantly **pulling** tails (in the evolutionary sense) in the **direction** of getting longer* [BW 214].
- (35) *Remember that selection by females is **pulling** male tails in one **direction**, while 'utilitarian' selection is **pulling** them in the other ('pulling' in the evolutionary sense, of course), the actual average tail length being a compromise between the two pulls* [BW 208].

Observations and conclusions

Having presented the manifestation of the JOURNEY metaphor in the theory of evolution we can come back to our initial questions. Firstly, if we compare the metaphor in its original appearance in Darwin's work and over a century later, we can safely say that in the course of time it has become well entrenched and elaborated in the language of evolutionists. The original mappings are frequently used and new mappings are added. Thus, and this addresses our second question, its presence cannot be without consequences for the theory. Because direction, goal, purpose and progress are inherent part of JOURNEY, these elements of the source domain shape our understanding of the operation of evolutionary processes. The third issue concerned the status of the metaphor EVOLUTIONARY CHANGE IS A JOURNEY, whether it is a theory-constitutive or exegetical metaphor. Recall that for Boyd the

principal criterion distinguishing between constitutive and exegetical metaphors is paraphrasability: theory-constitutive metaphors cannot be replaced by literal equivalents. Not questioning the relevance of this criterion, I believe that other factors should be considered as well: Firstly, whether the metaphor is long-lived (which obviously can only be stated in the case of metaphors which have been in use for at least several decades); secondly, whether the metaphor was elaborated in the course of time and use; next, whether it generates inferences about the target domain, and finally, whether it could be removed from the theory (through paraphrase or through replacement by another metaphor) without causing profound changes in the theory.

Let us apply these criteria to the presented material. The journey metaphor proved to be definitely long-lived in evolutionism showing well-documented use for more than 150 years since its first appearance in 1859. Next, the way Dawkins exploits this metaphor shows its elaboration. Moreover, the elaboration is not limited to language but extends to visual representations. Pictures and video clips tend to show evolution of organisms as a literal movement on a path or even “highway of life”. Thirdly, the fact that evolutionary change is conceptualized as a journey is not without significance for how this process is understood. As we have already mentioned, the insistence on the necessity of transitory stages in evolution is partially an entailment of the metaphor: the theory predicts their existence in the form of fossils (or “living fossils”), and finding them is treated as a strongest evidence in favour of the theory, while their lack as heavy counterevidence. Finally, to my knowledge, there are no alternative literal locutions available for a description of evolutionary change. Talking about evolution as movement in space has become conventionalized and is not recognized as a metaphor. What is more, I believe that any attempt to remove this metaphor would be devastating for the theory. Consequently, we can conclude that the metaphor EVOLUTIONARY CHANGE IS A JOURNEY is constitutive for the theory of evolution even by the extended criteria proposed in this paper.

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Summary

EVOLUTIONARY CHANGE IS A JOURNEY: From Darwin to Dawkins

The objective of this paper is to investigate the role of the metaphor EVOLUTIONARY CHANGE IS A JOURNEY in the text of its original appearance (Charles Darwin's *On the Origin of Species*) and its later developments (texts by Richard Dawkins). An analysis of selected examples allows a conclusion that EVOLUTIONARY CHANGE IS A JOURNEY is a theory-constitutive metaphor for evolutionism. The paper also proposes an extended understanding of the whole concept of theory-constitutive metaphor.