

SCHOLARLY ARTICLE

Rethinking Science: From Evolutionary Metaphors to Mirror

Reflections in Philosophy

Dr. Barbara Gabriella Renzi

Abstract

The main question of this paper is: why have philosophers of science like Popper, Kuhn, and Hull compared the change of science over time to evolutionary theories, invoking evolutionary epistemology? Why do they use the evolutionary metaphor or analogy to describe scientific change? A historian might attribute this to the societal popularity of evolutionary theory during certain periods. However, this exploratory paper approaches the question from a philosophical and psychological perspective. Despite the clear fallacy that human beings intentionally drive changes in scientific theories, whereas evolution lacks intentionality, the evolutionary metaphor has been seriously considered by these philosophers. The application of science and technology has yielded both benefits and significant problems, creating doubts and fears about issues like climate change, atomic bombs, and pollution. Philosophers may have unconsciously sought parallels between science and nature to create a reassuring imaginary, presenting science as a robust "organism" capable of adapting to environmental challenges. Thus, the thesis is twofold: philosophers used the comparison to establish science's distinct identity and to offer a comforting vision of its resilience.

Keywords: Evolutionary epistemology, scientific change, Popper, Kuhn, Lacanian psychoanalysis.

Rethinking Science: From Evolutionary Metaphors to Mirror Reflections in Philosophy

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The Evolutionary Analogy

The evolutionary analogy is a particular form of evolutionary epistemology which claims that scientific change is governed by mechanisms analogous to organic evolution. The main question is the following: is the process of scientific change analogous to or even the same as organic evolution? Maybe one of the main problems with this view was implicitly equating the sociological and more popular view of Darwin with the biological one. One of the main results of the evolutionary analogy was the idea that the better theories are those which survive old ones, as better species are those which survive previous ones. Some philosophers have embarked on a sketch analysis of this comparison while others have tried more persistent attempts.

Various articles and volumes, for example, Renzi and Napolitano (2009), have shown that the metaphors provided by these philosophers are less than satisfactory since they often misunderstood and simplified the biological concepts and they forcefully introduced in their view of scientific change mechanisms that are counterintuitive and damage their own theories. This article is not going to discuss the views of the descriptive philosophy of science in detail, but this paper is applying a metaphor – the mirror one - to describe the Philosophy of Science to better comprehend their attempt of equating or comparing scientific mechanisms with the ones of the organic world. Before illustrating and analysing the mirror metaphor, this paper will briefly introduce the concept of metaphors as cognitive structures and describe some of the most important attempts of evolutionary comparison to have a more complete starting picture which will help the introduction of the mirror analogy.

Natural Selection and Evolutionary Epistemologies

Natural selection is now widely agreed to be the principal force that changes allele frequencies within large populations. In biological populations, competition for survival usually occurs because more offspring than can survive is produced. Because of genotypic variety, greater capacity to survive and reproduce is usually possessed by some individuals, whose genotypes produce phenotypes better equipped for their environment. Succeeding generations will preferentially inherit their alleles, which will increase in frequencies in the population. Evolutionary epistemologies are epistemologies directly motivated by evolutionary considerations. Metaphors and models from evolutionary biology are used to address and solve epistemological issues from an evolutionary point of view. As a whole, they are also referred to as the 'Evolutionary Analogy'. The expression 'Evolutionary Epistemology' is used to group together different attempts of using biological concepts in philosophy and is traditionally associated with the names of Donald Campbell, Stephen Toulmin, and Karl Popper. Here this paper will consider exclusively evolutionary epistemologies belonging to the so-called Evolutionary Epistemology of Theories (EET) programme, which attempts to give an account of epistemological norms and human knowledge. The most common objections to the EET program are probably the following three (Bradie 1997). Firstly, although an apparent design can be detected in the Universe, a possible mechanism for the development of intelligent life in the absence of evolutionary goal and direction was provided by Darwin. Life evolution, however, is often pictured using the image of a branching tree and science could not make any use of this representation, since science is goal-directed and appears to proceed along completely different lines. Secondly, many theorists of EET consider the production of conjectures to be a 'blind' process, followed by a selective stage. It is often objected that this cannot be the case: the hypotheses generated by scientists are not random, since they have been

formulated in order to solve particular problems. The third point concerns the progressive success of science, seen as a sort of 'fit' between knowledge and the world. In evolutionary biology, however, it seems impossible to identify any sort of general progression of the whole biological realm, because there is no fixed environment to fit even for a single species. These objections are answered by several philosophers in different ways.

What is the risk of supporting 'wrong' analogies?

When we use analogies, we compare two elements A and B that we believe are similar in some sense: we analyse A, grasp a certain set of properties, and try to find the same set of properties in B. Analogies can stimulate our thinking, help us to explore in detail and lead us to discoveries. Analogies can have a strong heuristic power and may be useful in different situations. This paper has argued that the evolutionary analogy is inappropriate in the philosophy of science, but it also claims that it produces negative effects in evolutionary biology itself. This is where the reversed analogy comes into play. When we are comparing two objects, we can argue analogically that if A has an interesting property this is likely to be found also in B. This is what occurs in the case of the 'direct' analogy from biology to philosophy of science. However, this opens the possibility of also going from B to A by following a reverse analogy, in our case from philosophy of science to evolutionary biology. Because natural selection is often misinterpreted and misused by philosophers or scholars in general, the danger is that the misinterpretation in one subject might lead to confusion in the other. More specifically, it could distort our understanding of natural selection and, in general, of Darwinian evolution. It can also reinforce stereotypes, probably rooted in Spencer's philosophy, that are still strong and popular, as shown by movies such as *Antz* or TV shows such as *Star Trek: The Next Generation* (episode 'Hide and Q', specifically). Both the film and the TV feature are informed by the idea that evolution is progressive, goal-directed and that

there are 'better beings' in an absolute sense. In the case of Antz the process of evolution is pictured as producing stronger individuals, physically bigger and more able to fight over time; in 'Hide and Q', on the other hand, the idea is supported that humans will progress to higher states of being, thanks to their curiosity. Furthermore, if such metaphors are seen as cognitive metaphors, the issue becomes even more complex.

In fact, metaphors are cognitive structures by which we create our world. Metaphors are present in our everyday life and the reason is that the nature of our ordinary conceptual system is metaphorical: the locus of metaphor is the way we conceptualize one mental domain in terms of another. Metaphors are conceptual mappings, that is, they are a matter of thoughts and action, and not only later a matter of language. To talk about abstract concepts, we choose language drawn from the concrete domain, for instance, we use spatial mapping to speak about the mind: things are in the mind or out of it. Things pass through mind and we call things to mind. Knowledge is also created through the metaphorical understanding built on the physical experience.

Some insights into interaction theory

The passage from interactive to cognitive theories of metaphor has its precursor in Max Black, who developed Richards' theory in a specifically semantic-cognitive direction, reformulating it as a projective theory. Also, for Black the metaphorical effect is an interchange between a primary and a secondary subject and, as for Richards, the metaphor does not result from the substitution or comparison of two meanings, one literal and one metaphorical, but from the interaction between two thoughts, from which a new meaning arises. The novelty lies in understanding the metaphorical process as an interaction between two schemes, namely, as the projection onto a new conceptual scheme of a pre-existing conceptual scheme. For example, the metaphor "homo homini lupus" evokes a system of shared commonplaces about wolves,

selecting them at the expense of others as inessential to the new meaning of "man". The metaphor organizes our vision of what to be a human being means. We can say that the main subject is "seen through" the metaphorical expression, or - if one prefers - the main subject is "projected onto" the field of the subsidiary subject. Such an operation, on the other hand, also transforms the secondary subject, so that, in this case, if calling a person a wolf means putting him/her in a special light, we must not forget that the metaphor also makes the wolf appear in a more human light.

It must be stressed that the level of action of metaphor, in Black's perspective, is no longer that of the word, but of the utterance. Finally, the cognitive function of metaphor does not consist simply in highlighting aspects of a subject: it is something more, a constitutive function, which helps us to see aspects of reality that it itself helps to constitute. Paul Ricoeur, a French philosopher, describes metaphor as an essential part of philosophical discourse. Philosophical language uses metaphor to derive and bring out new meanings and aspects of reality. It is 'alive' precisely because it provides, through the imagination and the expressive and emotional force connected with it, a 'more conceptual thinking'. Ricoeur, like Black, highlights the fact that metaphor does not belong to the circumscribed dimension of the word but, rather, to the semantics and dynamics of discourse, a position that has made an important contribution to overcoming the traditional dichotomy between the literal and the metaphorical.

All the dangers of the interaction between natural selection are clear as above stated, distorting both our understanding of natural selection and science. The issue could also be analyzed from a cognitive point of view, but this paper refers to articles already published on the subject.

The book "Metaphor and Everyday Life" by George Lakoff and Mark Johnson (the former a linguist, the latter a philosopher) aims to identify those areas of everyday language that are unconsciously "imbued" with metaphors. For the two American scholars, metaphor is

not a phenomenon of mere poetic embellishment and therefore the prerogative of literature but is the mechanism that pervades our communication on a massive scale. Metaphor is indeed a moment of everyday language, but - and here is the "strong" thesis of Lakoff and Johnson - it is the way in which we human beings structure our concepts and therefore reality. A metaphor is a cognitive event before being linguistic. The linguistic utterance is nothing more than an epiphenomenon of cognitive activity. Metaphor is primarily a matter of thought and action, and only derivatively a matter of language. In fact, our common conceptual system, on the basis of which we think and act, is essentially metaphorical in nature". Using more metaphors, substituting new metaphors for those that are now obsolete and crystallised, allows us to grasp new aspects of reality that were not previously contemplated. For Lakoff and Johnson, figurative language is the foundation of literal language and not vice versa. Already Aristotle, in the "Poetics" and the "Rhetoric", explains how metaphor, by its very nature, allows us to connect apparently distant semantic-conceptual domains and create, through semantic identifications, cognitive "insights" in the subject.

A discussion can be metaphorised through war or dance, different metaphors will give us different conceptions and different aspects of concepts.

Orientation metaphors: Metaphors do not only structure single concepts but also sets of concepts. That is, certain starting concepts can be used to organise the relationships between other concepts. The so-called orientation metaphors, so called because many of them have to do with spatial orientation: up-down, in-out, front-back, etc., are also very important in this respect. These spatial orientations derive from the very constitution of our body and its functioning in the physical environment around us. Orientation metaphors give the concept a spatial orientation: for example, happiness is up. The fact that the concept contained is oriented in the up direction results in expressions such as 'I feel up today'. These metaphorical orientations are not arbitrary, as they have a basis in our physical and cultural experience. But,

although the oppositions up-down, in-out, etc., are physical in nature, the orientation metaphors based on them may vary from culture to culture (Lakoff and Johnson *Metaphors* 33). As we have said, however, these metaphors serve to structure systems of concepts. It follows that if "happy is up", then "sad is down". Thus, alongside expressions such as 'feeling up' and 'having high spirits', we will have 'feeling down', 'being depressed', 'having low or low spirits', etc.

7.2.4. Lakoff-Johnson and Eco We can see that Lakoff-Johnson's theory can be perfectly harmonised with Eco's theory¹. The mechanism on which the metaphor is based is the same: a "similarity", i.e. a commonality of certain traits. The fact that a metaphor highlights certain aspects of the concept and hides others can also be traced back to the Eco idea of the metaphor that exalts some traits and narcotizes others. Indeed, Lakoff and Johnson's intuition is as simple as it is ingenious. To export the idea of metaphor from the simple linguistic field to the conceptual one. A passage of this kind, however, is also present in Eco. And it is present in Eco partly because it was already present in Aristotle. To speak of the cognitive value of metaphor, and of how metaphor makes us discover new things, is, in fact, to say that through it we continually restructure our knowledge, that is, our conceptual system.

Now that we have clarified what we intend as a metaphor, a cognitive mechanism that restructures our knowledge we will need to answer the following questions: 1. Why the persistence of evolutionary metaphors when the impossibility of a real comparison was clear? In order to answer this question we will use a different metaphor and go back to Lacan. 2. What consequences can have the comparison with or the metaphor evolution in relation to our image of science?

¹ Eco's theory of *unlimited semiosis* posits that the meaning of a sign (a word, image, or symbol) is not fixed but is continuously deferred through an endless chain of interpretations. A sign can refer to other signs, and the interpretation of these signs depends on the cultural, historical, and contextual framework of the interpreter. Eco's theory allows for multiple layers of meaning but also insists that not all interpretations are equally valid, particularly when the boundaries of reason are exceeded (e.g., overinterpretation). (Eco, U. 1976).

Why this persistence in the evolutionary metaphor?

The insistence on the evolutionary metaphor might be explained with a psychological hypothesis and metaphor. Nature is the mirror in which the mother (philosophy) and science (the child) are mirrored and evolution through natural selection is the image on the mirror. This metaphor has its roots in the relationship between philosophy and science.

Although the definition of philosophy is not so simple one might say it is an activity that uses reason to explore and understand questions of nature (metaphysics), rational thought (logic), the limits of our understanding (epistemology), the moral good (ethics), the nature of beauty (aesthetics). In ancient civilisations, it has been a philosophy that has explained everything in the world. Science, as a study of natural phenomena, has been there for no more than three centuries. In fact, what we call science today was labelled as natural philosophy at the beginning of its journey. However, science has grown by itself so that it is no longer possible, nor is it feasible, to try to find loose ends to join science with philosophy. Science makes an effort to make sense of various phenomena. Scientific explanation requires help from concepts and equations that require proper explanation and study and cannot be understood by someone who had not a specific training. The scientific text is technical, complex and requires an understanding of mathematical concepts in order to have a better understanding. Even though science began its journey as a philosophical thread (natural philosophy), now it can be seen as something distinct. For this reason, we can apply the Lacanian concept of the mirrored stage to the comparison made by many philosophers of science between scientific change and evolution. In our analogy, we consider philosophy to be the mother with science at her side, using nature as a mirror to show evolution to science, telling it that it is its image.

A sub-question is the following: why using the Lacan concept of the mirror stage? Through the mirror stage, the child perceives the differentiation from the mother and acquires an “I”.

The mirror stage

The main questions of this paper are: why have philosophers of science such as Popper, Kuhn, and Hull compared the change of science over time to evolutionary theories, invoking evolutionary epistemology? Why do they use the evolutionary metaphor or analogy to describe the change of science over time? A historian might attribute this to the societal popularity of evolutionary theory during certain periods. However, this exploratory paper approaches the question from a philosophical and psychological perspective.

The mirror stage, according to Jacques Lacan, represents a critical period in a child's development, where the acquisition of a form of identification determines a modification in the child's psychic organization. This process, occurring between 6 to 18 months, involves the child seeing a reflected image and producing the (gestalt) idea of a total form of a body, their own. This primary identification, characterized by the child recognizing themselves in the mirror, serves as the symbolic matrix of the primordial Ego and becomes a container for future projections of the Ego.

Initially, the child identifies the mirror image as another individual, a stranger. Eventually, the child realizes this image is their own reflection, marking a significant moment in their psychological development. This recognition allows the child to form a unitary and definite self-image, differentiating themselves from others and becoming self-conscious. The mirror image facilitates the child's realization of their physical boundaries and separation from the mother, providing a sense of security against the anguish of annihilation caused by being outside the maternal containment.

Lacan posits that this mirror stage is foundational for all subsequent identifications, with the child identifying with a duplicate of themselves—an image that is not them but allows self-recognition. The subject or ego is not an original datum but a construction resulting from

this mirror stage, where the child elaborates a first sketch of the Ego within the imaginary realm, characterized by a dual relationship of confusion between self and other.

In the initial months, the child is dependent on the other and is at the mercy of bodily chaos—a fragmented body. In front of the mirror, the child initially reacts as if the reflected image is a reality that can be grasped. Eventually, the child realizes it is an image and understands it is their image, different from the adult holding them. It is the gaze of the other, particularly the mother, that gives the child recognition of their unified and autonomous image. This process of seeking the gaze of others to define one's own identity starts when the mother confirms that what is seen next to her is indeed the child.

The mirror stage provides a stable fixed form that anticipates the self-control and stability the child will achieve later. The self-image necessarily passes through language and the gaze of others, with the mother's cohesive reflection of herself being crucial for the child to recognize themselves as a unified figure. Despite its dramatic form, the mirror stage establishes a link between the organism and reality, producing real phantasms in the child who transitions from a fragmented image to a "total" mirror image, marking future mental development and social interactions.

Lacan suggests that an externally reflected form can have a formative function in the individual, demonstrated biologically, such as the maturation of the gonad in the female pigeon upon seeing a congener. The mirror stage is the matrix from which the Ego takes shape, with the mother's behaviour, verbal and non-verbal, playing a fundamental role in the child's formation of self-esteem, language, and posture.

The mother's gaze in the mirror provides the child with a crucial moment in their personality development. Initially, the child sees another person, but upon meeting the mother's gaze, they realize the image is their own. This first identification, imaginary and dependent on the mother's gaze, is alienating, leading to the primordial alienation of the Ego. The child's joy

in imagining themselves as a whole, rather than a fragmented body, represents a significant step towards accessing reality.

Lacan's complex thought stimulates reflection on the ontological dimension of the birth and origin of a highly evolved yet biologically fragile psychic and physical apparatus, highlighted by current epidemiological effects. The problem of fragility, manifesting through anxiety and momentary fears, forces humans to confront otherness—both the otherness of others and our own otherness. Accepting our inadequacy, weaknesses, and limitations is essential, as every human being has an ontological 'fracture' that opens us to desire and joy. This exploration of the mirror stage connects to the descriptive philosophy of science. Philosophers used the evolutionary analogy to explain science and give it an identity distinct from philosophy. The metaphor of the mirror stage suggests that nature, as the unifying principle of all organisms, acts as a mirror through which science sees its unified image, guided by the wise gaze of philosophy. This process separates science from its mother, philosophy, raising questions about whether science truly needs this guidance to form a unifying principle and the extent of its separation from philosophy. These questions invite further exploration as the evolutionary analogy proves insufficient.

Creating reassuring Imaginary: a dreamscape of science

Deliberately drawing on the book of Sheila Jasanoff and Sang-Hyun Kim here I argue that the evolutionary metaphor or analogy creates a positive and reassuring imagery of science. Metaphors and analogies through the interaction of concepts change the internal structure of the concepts included in the comparison. Science is seen through the lens of evolutionary theory. Natural selection produces strong organisms that are adapted to their environment and

survive. What becomes of science? Science as a product of evolution becomes another organism, which is strong and adapted to the environment in which it lives, which props up and which improves over time (the concept of becoming better is not of the theory of evolution itself but more of the misrepresentation of science and common thought). We other organisms who use science, who have become scientific organisms and rely on science do nothing but thrive and improve as a result. And how could it be otherwise? If we rely on something that has passed the selection test? The survival of the fittest becomes a reassuring but dangerous vision. Its consequence is that we settle into an almost 'mystical' belief that science is always and everywhere something good and 'strong', suited to the environment. On the other hand, we know very well that scientific theories and technologies can be like any tool, a knife for example, which can be used to cut bread or kill people.

Considering science through the mirror stage gives us an ideal image to which science itself fails to conform. We see it as something perfected to which we must be inspired that can only make us nervous. We do not look at it with critical eyes and above all we do not look at its products with critical eyes; which can always be problematic especially if we notice how much pain and how many serious problems the misuse of scientific discoveries has caused. If we regard science as a natural product of a process that only the best 'wins' we take our hands off all responsibility: instead, the use of science and its technological products are always our responsibility.

The metaphor of evolution applied to science is not only unsustainable but also harmful, since it gives us an idealised and unaccountable image of science, or rather it is we human beings who relieve ourselves of all responsibility and leave it to a mechanism that has in any case led to our existence. Perhaps philosophy unconsciously no longer wanted to take care of its child and denied all responsibility for actions committed in the name of science, especially concerning the use of technology.

This would surely be a grave error, not only because an unthought life is not worth living, but also because developments in science and its applications must be thought through. These are crucial questions that also concern the concepts of life and death. We cannot feel disempowered by leaving everything in the hands of what we want to perceive as a blind mechanism.

Conclusions

The metaphor of evolution cannot be applied to scientific change, not only because it clearly does not work but because it leads to an idealised imagery of science that could have inauspicious consequences. The stage of the psyche may not yet have been passed by science, and philosophy must continue to mother its problem, including discussing the use of technology and its development.

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