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Popper and the Theory of Evolution

Abstract

This article examines the ideas Popper propounded about the scientific status of the theory of evolution, about whether the theory has a truly scientific character. I first present Popper's perspective on the criteria that need to be met by the kind of knowledge that claims to be scientific. In the following, I discuss Popper's basic theses in the philosophy of science and their implications for an assessment of epistemological structure of evolutionary theory. Basic position of evolutionary theory concerning biological reality is roughly described, with a view to bringing out the structure of evolutionary argumentation. I note that while Popper, up to 1977, maintains that the evolutionary theory is a "metaphysical research programme", a comprehensive and fertile one, he, in his later thought, abandons this claim and attempts to carve out a scientific status for the evolutionary theory, which, however, involves some tensions for the whole logic of the falsificationist strategy.

Key Words

Theory of Evolution, Philosophy of Science, Scientific Knowledge, Metaphysical Research Programme, Falsifiability, Biological Knowledge, Metaphysics.

Popper ve Evrim Teorisi

Özet

Bu makale, evrim teorisinin bilimsel statüsü hakkında, bu teorinin gerçek anlamda bilimsel bir karaktere sahip olup olmadığı hakkında Popper'in ortaya koyduğu fikirleri incelemektedir. Önce Popper'in bilimsel olma iddiasındaki bir bilgi türünün karşılaması gerektiğini düşündüğü kriterlere ilişkin bakış açısını sunuyorum. Devamında, Popper'in bilim felsefesi alanındaki temel savlarını ve bu savların evrim teorisinin epistemolojik yapısına yönelik imalarını tartışıyorum. Evrim teorisinin biyolojik gerçekliğe ilişkin temel konumu, evrimci argümantasyonunun yapısını ortaya çıkarma gayesiyle betimlenmektedir. Popper'in, 1977'ye dek, evrim teorisinin "metafizik bir araştırma izlencesi" olduğunu, ve verimli ve kapsamlı bir izlençe olduğunu, öne sürdüğünü, ama geç dönem düşüncesinde bu iddiasından vazgeçtiğini ve evrim teorisine bilimsel bir statü kazandırmaya giriştiğini, ancak bunun da tüm bir yanılsamacı stratejinin

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mantığı açısından, beraberinde getirdiği bazı gerilimlerin bulunduğunu not ediyorum.

Anahtar Sözcükler

Evrim Teorisi, Bilim Felsefesi, Bilimsel Bilgi, Metafiziksel Araştırma İzlenesi, Yanlışlanabilirlik, Biyolojik Bilgi, Metafizik.

Popper's theory of scientific methodology has become widely influential in the philosophical landscape of English-speaking world. It introduced novel and creative criteria for the ascertainment of what is truly scientific and what is not. In other words, Popper, in a very productive way, addressed the question: What distinguishes the scientific knowledge from non-scientific ones? Which kind of statement or theory can be qualified as scientific? Social dimensions of scientific knowledge and the political implications of science have all become popular issues after Popper's "bold conjectures" have come to be well-known by a large audience and to strongly inform the public opinion since the 1950s on.

Popper, among other things, had a special interest in biology and in particular, the theory of evolution and in the problems or controversies associated with the scientific status of the theory. He expressed his ideas about the issue on many occasions. The first thing to note is a deep inspiration the theory exerted on Popper's thinking such that he qualified his own epistemological approach as evolutionary from 1960s on. On the other hand, the influence of the theory on modern mind is massive: it is the single theory that in the previous century paradigmatically shaped up all biological research generating, at the same time, some peculiar problems and a bitter controversy not only in the scientific world, but also in public life.

Popper's ideas on the theory of evolution have changed over years, from his early criticism of historicism to his mature thought expressed in his writings in the end of 1970s and 1980s. His early position has been the view that the theory of evolution is basically metaphysical and must be considered, in its fundamental lines, as a "metaphysical research programme" (which as a heuristic devise or stage is indispensable for the maturation of any theory towards an adequately scientific form) (Popper 1972). Another connected issue is the worry that the theory itself is tautological and unfalsifiable, that is, there is no way, in principle, to show that the theory might be false (Popper 1976). Let us add, the term "metaphysics" in Popper, as opposed to Logical Positivists, is not meant in a pejorative sense. It is a constitutive stage of knowledge necessary for and conducive to the formation of scientific hypotheses. Popper's mature ideas on the theory, however, shows a qualified distantiation from this earlier prohibitive approach, while he himself tends to be, more and more, inspired philosophically (or metaphysically) from the theory especially concerning the issue of mind and body-mind connection. He seems to welcome the theory into the realm of perfect science either as a whole in its present form or together with the attempt at methodologically improving the basic concepts of the theory, or in both ways.

In order to get clear about Popper's methodological theses concerning the theory of evolution, we need to investigate, albeit roughly, basic elements of Popper's position

concerning what is entitled to be called “scientific knowledge”. Having clarified Popper’s philosophy of science in its basics, we are going to present his ideas on evolutionary theory and see the picture more concretely. Our final remarks try to connect Popper’s methodology, the theory of evolution and the question whether the evolutionary theory does really possess a properly scientific character or it is a proto-scientific enterprise, which, one may hold, in the hands of some hidden agenda became absolutized, whereby ending up as a tool of ideological dogmatism, much like Marxism and Freudianism, which one could, as Popper did in the 1940s, directly associate with the totalitarianisms of the 20th century. This socio-political potential of knowledge is something Popper always bears in mind and draws attention with respect to its negative or positive effects for the possibility and functioning of an open society. One might even speak of decisiveness of a sort of social reflection (i.e. the ideal of open society) as a hidden horizon in Popper’s philosophical attempt at theorizing the nature and conditions of that specific kind of knowledge (“the scientific knowledge”) which can not only make such social reality possible but also sustain it in the long run. We will see that Popper, in his mature thought, is anxious to dissociate the theory of evolution from this kind of pseudo-scientific theories.

I. Popper’s Theory of Science in Its Basics

Popper’s central insight that determines his entire outlook in the philosophy of science and later on in the fields of political and social thought stems from an epistemological conviction that it is not experience (induction) but hypothetico-deductive propensity of human mind which is the ultimate originating source of human knowledge. Problems, rather than particular experiences, are truly functional to the operation of human mind, to the formation of human knowledge. Problem-solving in the manner of critical thinking forces us to conjure up a hypothesis, a conjecture which we then put to empirical testing up to the very point we receive a negative answer. Science, roughly speaking, operates in that manner. Empirical data do not reveal the structure of reality, as naïve empiricism took it. Exploring the structure of reality is not something that can be carried out on an inductive basis but fundamentally a matter of high level deductive thinking which in each case needs to be shaped up by the negative evidence experiential data provides. Science rests on the kind of deductive thinking which is characteristically critical and which crucially lends itself open to the possibility that it might be false. In other words, our deductive propensity proceeds through formulating hypotheses, which, to be scientific, must in principle be open to falsification by experimental conditions. But in the initial stage hypotheses (or conjectures, guesses, ideas, theories) are too bold such that they lack the property of falsifiability. The initial stage of all human knowledge is determined by these speculative hypotheses (i.e by metaphysics) which, no matter not open to falsifying examination, renders a vital heuristic function on the way to the formation of concrete factual theories which are empirically testable (see, for instance, Popper 2002: 1-35, 465-480).

Popper, in this context, took quite seriously Humean induction problem and tried to circumvent it by proposing a deductive origin for human knowledge. Human knowledge at this epistemological level can be divided into two consecutive phases, into

two organically related, developmental steps; metaphysics and science. Metaphysical propositions are neither meaningless (and thereby not to be dismissed altogether from the universe of human knowledge) nor unenlightening. They are necessary, instrumental and prerequisite for the emergence of scientific hypotheses. Then what marks off science from non-science, that is, from metaphysics? (the so-called “problem of demarcation”). The criterion Popper offered for the demarcation of science from non-science is the criterion of falsifiability. As indicated above, conjectures possessing scientific property are distinguished by the fact that they are open to empirical testing, that is, they are, in principle, falsifiable and contain no element by which to manoeuvre in the face of a falsifying evidence by way of introducing *ad hoc* or elusive assumptions. As Popper puts it: “but I shall certainly admit a system as empirical or scientific only if it is capable of being tested by experience. These considerations suggest that not the verifiability but the falsifiability of a system to be taken as a criterion of demarcation” (Popper 1968: 40).

Falsification of one theory sets the stage for another theory (produced in the form of a critical hypothetico-deductive assumption) which is better, more proximate to truth, having a higher verisimilitude value, than the previous one. Such never-ending approximation to truth is inherent in the very strategy of science. Though we perhaps will never be able to formulate truth, we, via science, will get increasingly near to it.

No universal empirical theory can be proved, but if it is scientific it can be disproved. Scientific knowledge grows on the basis of this disproof, that is, by the impact of negative evidence. Science is a dynamic, an open-ended activity which has the potential for changing itself continuously. Accordingly, no theory can be set up beyond doubt, no theory is final, no theory is immune from the razor of possible falsification.

We do not know anything beyond doubt, but we can guess. And in time our conjectures become more and more complicated, refined and developed. This naturally implies that science does not start with pure observations, but with problems and conjectures which get refined in process. Observations become the result, and not the source, of problem-oriented thinking, that is, of theories: all observations are theory-laden and accordingly there are no pure facts. Then one should ask: how do we form hypotheses, if induction and observation are denied any principal (and indeed any “rational” status) role in theory making? Popper’s answer: we formulate hypotheses by the very propensity to guess, a propensity characterizing human mind, our relation to the world. In science, our conjectural propensity becomes highly critical, self-conscious, systematic and comprehensive. Thus, in general lines, the picture is this: the propensity to guess in humans, as response to the needs of life, shows itself in the form of problem-solving enterprise and gives rise to deductive conjectures, which are later put to empirical testing. If it is corroborated, it survives only until next time’s battle which is inextricable. If it is falsified, we can have now the chance to develop a “better” conjecture. This “betterness” obtained thanks to falsification is the only way we can designate the progress of knowledge. At best, we can speak of “corroboration” of a scientific theory, not its final confirmation as the logical positivists assumed. Within an infinite world of possible facts, we should be content ourselves with a “finite or

provisional quality” for the truth of our scientific propositions. In short, we learn essentially from our errors.

Thus Popper’s position implies that all science and scientific claims are originally metaphysical and born out of the heuristic and intuitive function of metaphysical speculation. The way from metaphysics into science is a matter of evolutionary development, say a Darwinian movement, proceeding through trial and error-elimination (natural selection). Hence, perhaps, Popper’s (qualified) sympathy for the theory of evolution (see, Popper 1990: 27-51 and Ruse 2008: 267-277).

II. The Criterion of Falsifiability, Historicism and the Theory of Evolution

Before setting out an examination of evolutionary theory from the perspective of Popper’s theory of science, I want to present evolutionary theory in its general lines as I understand it, in reference to which to carry out our inquiry.

Evolution is a theory of change of living reality. The designation “evolution” may be misleading, as many evolutionists think, because the kind of evolution evolutionary theory talks about is not necessarily development; it can also be just the opposite. (However, it is clear that highly complex living organisms, the theory implies, have somehow developed from the simplest ones, a thesis through which evolutionary theory accounts for such complex and wonderful life.) Yet such change must be genetical change, i.e., a change in the genetical composition of a population. Hence evolutionary theory is a theory of biological change behind which one discerns an adventitious and opportunistic causality, perhaps as the outward appearance of the instinct for survival living organisms exhibit in their relation (which is essentially “adaptational”) to environment. Such change in the genetical composition of a population which is to be reflected at the phenotypic level (i.e. in morphological, physiological and behavioral traits) is thus always an inheritable change, which is, for the theory, the essential phenomenon of the living nature and its essentiality constitutes the principal interest and focus of evolutionary theory. This view of living reality implies a common descent for all living organisms: all terrestrial life, like a tree, ramifies genealogically from one common homogenous biological material through modification and in a huge span of time. The temporal dimension is quite important, because the vast timeline of the evolutionary process (4.5 billion years) is often used as a case for the plausibility of the evolutionary ideas or the evolutionary results.

Natural selection is the most important mechanism and factor on the basis of which evolutionary process, i.e. descent with modification, is set into motion. Descent with modification implies that new species emerge from ancestral ones under the impact of environmental forces. Environment, in turn, is to be construed in a very broad sense to comprise all the natural forces including the very population in which a living organism is found to exist (Sober 1984a: 13-59). Even if natural selection is not the only factor behind evolutionary change (one should also include mutation, genetic drift, migration etc.), it is definitely the core thesis of the theory, for some (including Popper), though, the tautological, and thus untestable, center of the theory. It refers to the survival of the fittest. But how can we describe that which is the fittest? The answer: it

is that which survives! Fitness, nevertheless, is the major instrument of natural selection. Simply put, it is well-adaptedness to environment, which, taken according to the logic of evolutionary theory, means the capacity to survive and reproduce, in response to or in spite of all the material conditions involved. Survival requires that organism respond to environment in ways that maximise its fitness. Fitness, hence, involves reproductive success which guarantees the survival of the species, and species are to be viewed primarily as “populations”. Let us note that evolutionary notion of species, too, invites many critical questions (Lehman 1967). At any rate, it is easy to see that the concept of fitness de-emphasizes the environmental (external) factors in favour of the active response of the living organism to the environment. This is in fact, as Popper indicates, an important tension in the theory. Indeed, such a notion is not perfectly coherent within a theory which rests radically on the determinism of environment (i.e external material conditions) and on the passivity of the living organism to environment.

Another crucial insight of the theory is that living reality is not the unfolding of a static, pre-programmed developmental formation (such as the sort typically observed in the Aristotelian biological scheme or in the creationist theory), but it is viewed across a huge span of time, across an evolutionary schedule in which species, as a consequence of adaptive behaviour, appear in an enormous plasticity. Out of this mechanic, there is always room for the emergence, or evolution, of surprisingly new possibilities of living reality from the older ones. The evolutionary process, on the other hand, leaves behind some definite patterns in which the movement of change happens and through which subtle connections, the continuity, between the relatively older and newer forms become tracable.

Now, let us examine Popper’s views about the theory from the standpoint of his theory of science briefly sketched above.

III. The Pre-1977 Writings

Let us focus first on his critique of “evolutionism” found in his largely influential work, *The Poverty of Historicism* (written in 1936, published in 1957). In this work, Popper associates evolutionary theory with historicism and considers it simply as a variety of historicistic thinking. Evolutionary theory, unlike the anti-naturalistic versions of historicism, is pro-naturalistic, which means it “favours the application of the methods of physics” (Popper 1957: 2). The title of one section of the book is called “Criticism of Pro-naturalistic Doctrines”, which is largely devoted to the critical discussion of evolutionary theory as a historical theory. Popper departs from the idea that social prediction must be the central objective of social sciences; such prediction rests on establishing the law of the evolution of society through a historical account. A historicist attempt, in Popper’s view, is the attempt that tries to establish the laws of history or historical change, thereby being capable of predicting the future of human society in exact terms. In this sense, all social sciences bear the stamp of historicism for “the belief ... that it is the task of the social sciences to lay bare the *law of evolution of society* in order to foretell its future... might be described as the central historicist doctrine” (Popper 1957: 105-106). The attempt is, it seems, driven by the objective of

generalization and prediction, an unmistakable mark of scientific explanation. But what is wrong with this? The problem is that the kind of knowledge history involves does not possess predictive quality and therefore does not permit a predictive relation to its object, which is derivable solely from natural or physical phenomena. "The evolution of life on earth, or of human society, is a unique historical process... Its description, however, is not a law, but only a singular historical statement" (Popper 1957: 128). The point is that the facts of history (and thus of all other social studies) are not repeatable. Historical prediction projected always to proceed through evolutionary laws is not only impossible and inconsistent, but it is also a very dangerous way of approaching history. It is implied that historicist thought (especially its pro-naturalistic form) is inseparable from evolutionist premises and owes its appeal largely to evolutionism as applied to socio-historical world.

Consequently, the theory of evolution is not only a metaphysical theory; it is also a historical explanation, i.e not a natural explanation in the proper sense. The difference is that whereas scientific statements are universal statements applying to all natural occurrences, historical statements are about particular historical events, individual (or unique) and therefore unrepeatable and by definition unpredictable. "For in history (including the historical natural sciences such as historical geology) the facts at our disposal are often severely limited and cannot be repeated or implemented at our will" (Popper 1944: 265). In fine, we have singular nature of historical hypotheses as opposed to the universal nature of natural hypotheses, because history is a unique process. One should keep it in mind that the main target of Popper's attack here is the motivation to formulate "historical laws of succession", "natural laws of historical development" or "laws of motion of society" (e.g. Marx), which is inevitably unscientific and bound to fail, and which yet has proved to be the very source of totalitarian aspirations.

Then the evolutionary process as asserted by the theory of evolution is a historical process, unique, unrepeatable, irrevocable, ungeneralizable and thus unpredictable with respect to its future direction. For Popper, it is clear that "... there are neither laws of succession nor laws of evolution" (Popper 1961: 17). Besides, if there was such a natural law, it would be operative not on earth alone, but in the whole universe in the same way. He, in another work, *Objective Knowledge*, takes up the same point again: evolutionary theory is a "generalised historical explanation", which is as indicated above something paradoxical, because "the situation is supposed to be typical rather than unique" (Popper 1972: 270).

To expand on Popper's point, a few words might be afforded regarding the problematic historical character of the theory. It is obvious that the theory explains a temporal process of evolution of living reality stretched over millions of years. Given that man is part of living reality, historical dimension (or implications) of the theory is simply inherent and definitive. Accordingly, the theory, taken in its full range, can potentially explain the whole historical reality and what is more, this must be the final account of history, if the theory is perfectly true, as evolutionary biologists emphatically assert. The only way we might avoid this problem could be approaching to the theory as equipped with a radical indeterminism (as did Popper, later in his career, especially in *The Open Universe* [1982]). Otherwise, it is easy to see that the theory involves speculation, an empirical speculation that draws from an always insufficient and

imperfect material of facts (insufficient in view of Hume's critique of induction and imperfect in reference to its historical aspect, because the evidence is not totally available and the gap is filled by sometimes harsh "inferences"¹), which is supposed to represent the whole history of living organisms. In short, a speculative dimension to the evolutionary theory, as concomitant with its historical dimension, would be undeniable. From the inception of simple life forms to the evolution of complex organisms of the later stages, it comprises a number of billion years! Hence, historicism (formulating evolutionary laws for history) and the evolutionary theory (the ultimate explanation of history, human and natural) imply each other.

Now, let us examine Popper's critique of the theory in his article "Darwinism as a Metaphysical Research Programme" (Popper 1976: 192-210) in which Popper puts forward more systematic views. Popper starts by approaching first to evolutionary theory as a certain application of what he calls "situational logic". Indeed, for Popper, its close resemblance to situational logic accounts for its great success. What is implied by the connotation "situational logic" is roughly this: given that living reality has come about, evolution can be seen as an account of how it might behave; the account of evolutionary theory as situational logic seems a highly plausible game-theoretical description of possible framework of living behavior.

After a situational analysis, much like the kind of thinking practice evolutionary theory does, Popper suggests that it is better that we view living organisms as "problem-solving, rather than end-pursuing" (Popper 1976: 207). Here Popper tries to propose some sort of improvement for the theory of evolution; an improvement that tries to show what the theory might look like when formulated *scientifically* enough, that is, as a testable conjecture. Most probably the origin of life coincides with the origin of problems. Living beings' interaction with the surrounding world and its forces realizes in the mechanism of problem-solving. Accordingly, all history can be viewed as the history of interaction through problem situations. (Hence, Popperian dictum: life is problem-solving.) And problem-solving is learned by organisms through natural selection, that is, through trial and error-elimination, for which the case of knowledge, and ultimately of scientific knowledge, is the principal case in point upon which Popper's whole epistemology and scientific methodology rests. Then knowledge itself is nothing but a matter of adaptive strategy to the various uncertainties of a complex material environment (see, Popper 1995: 27-51). In other words, scientific progress, which is, for Popper, something "real", is inherently an evolutionary process based on the mechanism of natural selection, and this is just the continuation, in the human sphere, of vital tendency of problem solving found operative in organisms in nature. This is a conjecture for Popper and what is implied is that it is concretely testable if one can set up an appropriate experimental setting. In order to render evolutionary theory falsifiable (testable), Popper's thought-experiment narrows its horizon considerably by truncating the untestable assumptions – actually, one should accept, the most prominent ideas of evolutionary theory. In fact, Popper's proposal that problem-solving strategy be

¹ As S. Gould writes, "the evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the evidence of fossils." *The Panda's Thumb* (New York: Oxford University Press, 1980), 181. Quoted in Plantinga (1998: 689).

taken as basic to natural selection is not compatible with the passivism of the theory (the determinism of the environment) and this Popper is well aware of. It is for that reason that he endorses an “active Darwinism” which takes into focus the interaction between the living organisms and the environment (See, Rose 1998: 74-96).²

Even though Popper, in this work, seems to say that evolutionary theory possesses a promising framework for the growth of biological knowledge in a scientific direction, he is of the opinion that it would be wrong to take the theory of evolution, in its present form, as a scientific theory. Instead, it is an invaluable metaphysical research programme in biology, with no rival so far. Then, however, it is always, in principle, possible that a better one might be put forward some day and accordingly scientists in their scientific practice should be open to such a possibility.

Thus, Popper can be interpreted to maintain that the theory of evolution in its basic assumptions (such as descent with modification, fitness, adaptation, environmental favorability, mutation, etc.) lacks the quality of falsifiability, which means, it lacks all of the concrete requirements of scientific transparency, control and testability. Fitness is a point in case. He notes: “adaptation or fitness is defined by modern evolutionists as survival value, and can be measured by actual success in survival: there is hardly any possibility of testing a theory as feeble as this” (Popper 1976: 199). Concretely speaking, we need specific empirical predictions which can be corroborated, though provisionally, or be refuted. Popper puts it: “If, more especially, we accept that statistical definition of fitness which defines fitness by actual survival, then the survival of the fittest becomes tautological, and irrefutable” (Popper 1997[1963]: 90).

Michael Ruse argues, against Popper’s assessment (in that period), that evolutionary theory possesses a perfectly predictive quality (Ruse 1977: 650). However, the difficulty is that any prediction has, unavoidably, a “futural” dimension: what kind of predictions can be offered for the thesis that “all history of life has proceeded through descent with modification”. One should wonder what kind of modification will the theory predict for *homo sapiens*, for instance, i.e., for her evolution in near or distant future. And we should rightly demand that that prediction must be genuinely scientific, i.e exact with respect to both temporal and physical details. If one defends a predictiveness exclusively related to the the past history of life (e.g., Lloyd 1998), this, though less problematic than the future-oriented one, is, nonetheless, neither sufficient nor legitimate. Because it is easily open to *ad hoc* manipulation. And, more importantly, if you have valid scientific predictions, they must be generalizable, that is, applicable to all possibilities of the natural world, past and future, with specific implementations. Further, archeologists, too, can do striking predictions. Does that suffice to call archeology a science, in Popper’s sense?

Thus, directly relevant to the untestability and thus unfalsifiability of evolutionary theory is the fact that the theory explains too much. M. Grene complains of the pytholemaic epicycles of the theory: “whatever might at first sight appear as evidence against the theory is assimilated by redefinition into the theory” (Grene 1959:

² Rose bases on Popper’s unpublished “1st Medawar Lecture” (1986). The lecture is available as an audio cassette in the library of the Royal Society.

54). Evolutionary theory is broad enough to accommodate in some way almost any data that may be brought against it. Birch and Ehrlich put it quite lucidly: “Our theory of evolution has become, as Popper described, one which cannot be refuted by any possible observations. Every conceivable observation can be fitted into it. It is thus ‘outside of empirical science’ but not necessarily false. No one can think of ways in which to test it” (Birch and Ehrlich 1967: 352).

Roth’s attacks thus cannot be easily rejected:

No matter what is observed, there usually is an appropriate evolutionary explanation for it. If an organ or organism develops, it has positive survival value; if it degenerates, it has negative survival value. If a complex biological system appears suddenly, it is due to pre-adaptation. “Living fossils” (contemporary representatives of organisms expected to be extinct) survive because the environment did not change. If the environment changes and an evolutionary lineage survives, it is due to adaptation. If the lineage dies, it is because the environment changed too much, etc. Hence the concept is not falsifiable by any possible negative evidence. (Roth 1977: 8)

In this context, Popper’s claim makes sense: “Darwinian evolutionary theory is unfalsifiable ... I have come to the conclusion that Darwinism is not a testable scientific theory but a *metaphysical research programme*- a possible framework for testable scientific theories” (Popper 1976: 195).

IV. Popper’s Final Views on the Theory

In 1977, Popper delivered the first Darwin lecture in Cambridge University, which is published, one year later, as the article “Natural Selection and the Emergence of Mind”. This lecture is important mainly because Popper here presents us a perspective on evolutionary theory with considerable divergence from his earlier views. In this lecture Popper basically deals with the issue of “natural selection”, which he, as indicated, had qualified no more than a mere tautology, therefore not empirically refutable. He now comes to think that the idea of natural selection is empirically falsifiable and testable, and not a tautology. Is he saying just the opposite of what he said three years ago given that natural selection is the central thesis of the whole theory? Even though Popper “kindly” announces his recantation in the lecture, the matter here, I argue, is not so clear, because he still speaks as if there was a need to newly formulate, that is, to improve the theory of natural selection itself. At the very least we should observe that Popper is not completely happy with the present state of the theory with respect to the very standards that make a mental activity scientific. He sums up the core part of the lecture “Natural Selection and its Scientific Status”:

The theory of natural selection may be so formulated that it is far from tautological. In this case it is not only testable, but it turns out to be not strictly universally true...thus not all phenomena of evolution can be explained by natural selection alone. Yet in every particular case it is a *challenging research program* to show how far natural selection can be possibly held responsible for the evolution of a particular organ or behavioral program (Popper 1987[1978]: 145, emphasis added).

However, it also appears that Popper, as far as biology is concerned, believes that some form of evolutionary explanation based on natural selection, would conform to the standards of being scientific far better than any other non-evolutionary alternative. The problem is, then, how we can give this body of biological insights a scientific form, that is, how we can save the core content of the theory, the essentials of Darwin's point of view, within a truly scientific form. But nonetheless he has hesitations, which are revealed in the expressions like this:

In view of the difficulty, if not the impossibility, of testing the conjectural ascription of mental powers to animals, speculation about the origin of mind in animals will probably never grow into a testable scientific theory. Nevertheless, I will briefly offer some speculative conjectures. At any rate, these conjectures are open to criticism, if not to tests." (Popper 1987[1978]: 151).

Here the critical words are "... speculation about the origin of mind in animals will probably never grow into a testable scientific theory..." Each word, each implication, is important here.

Yes, he verbally makes a recantation, but doubt arises whether this recantation really has a philosophical substance, i.e. done in a fundamental relation to his own methodological premises. As a matter of fact, we cannot witness such an "account" in the lecture, but only a concession without serious justificatory content. To complicate things, he professes that his chain of reasoning in the lecture, inspired as it seems by the insights of evolutionary theory, would be "speculative" (metaphysical) in character. And he, a few paragraphs later, makes reference to Richard Dawkins' work, *The Selfish Gene*, as an exemplary account of such sort (Popper 1987[1978]: 152). Probably, he embraces Darwinism in principle, but circumvents the actual burden of accommodating the theory in his "own" scientific framework. And this has some costs. I shall explain a bit more.

We might read this new position of Popper concerning the evolutionary theory in two possible ways. According to the first one, Popper thinks that we need to look at the biological reality on the basis of "an" evolutionary model. But this does not mean that the current evolutionary theory (or at least the Darwinist version) is perfectly representative of such a model. Rather in order to acquire the quality of perfect science (in terms of predictive capacity and empirical refutation) there are still some metaphysical elements in the theory which the biologist should confront (see, Popper 1987[1978]: 143). In the second reading, Popper straightforwardly admits the evolutionary theory as perfect science.

If the latter is accepted, it seems, Popper should abandon certain basic elements of the idea of falsification. Because the evolutionary theory, though not completely untestable, does neither sufficiently allow empirical refutation nor possesses predictive capacity on a par, for instance, with the theories of physics. It has limitations on both scores. If empirical refutation and predictive capacity, both, are not seen essential, how can we speak of falsificationism any more? That is how can we speak of the possibility of testability in the real sense? Because "Popper sees this possibility of refutation by observation and experiment as the hallmark of genuine science" (Curd and Cover 1998: 63). One way, one might wonder, is to mitigate or minimize such Popperian strictures. But this invites the difficult question of "how" and "how much".

I view the second reading more probable than the former and it is supported by some assertions Popper made earlier in the *Objective Knowledge*:

Evolutionary processes or major evolutionary changes are as unpredictable as historical processes or major historical changes. I hold this view because I am strongly inclined towards an indeterministic view of the world, somewhat more radical than Heisenberg's: my indeterminism includes the thesis that even classical physics is indeterministic... And I think that evolution proceeds largely probabilistically, under constantly changing conditions or problem situations, and that every tentative solution, whether more successful or less successful or even completely unsuccessful, creates a new problem situation (quoted in Gonzalez 2004: 82, 1989 edition of *Objective Knowledge*: 296).

And, not surprisingly, in the first Darwin Lecture, he makes an argument for indeterminism in the midst of his discussion about natural selection (Popper 1987[1978]: 146). Popper attempts at sophisticating his indeterminism in *The Open Universe* (1982) where he argues that "...determinism is completely baseless" (Popper 1982: 41). Indeterminism is required, above all, by the free will and consciousness of human beings, by creativity in the natural world as well as by the irreducibility of biological knowledge to the physical one. Given that these points are taken by Popper in the terms of evolutionary theory (as is evident, for instance, in the First Darwin Lecture), we are compelled to wonder whether his growing commitment to indeterminism has a special connection with his concern with the evolutionary theory. However, in a radically indeterministic universe prediction would make little sense. Perhaps, given such an indeterministic picture associated with the evolutionary theory, one should also question whether we can consistently speak of the possibility of a comprehensive empirical refutation. Another curious point to see is whether such indeterministic interpretation of biological reality and of the evolutionary theory itself, is really compatible with the basic Darwinist point of view. Yet it is also plausible that Popper finds such indeterminism combined with the evolutionary theory more accordant with the demands of his conception of knowledge which is capable of systematically evading and impeding dogmatism of all sorts and thereby serving as the basis of an open society. As some argue, his understanding of rationality seems to have an ethical (or political) motivation (Gattei 2009: 78-85). To be sure, we cannot decide these questions here.

As a result, we observe that Popper revises his theses concerning the evolutionary theory in the late 1970s. He is now critical of the three interconnected observations he had made about the theory; namely (1) the theory simply fails in the face of the criterion of falsifiability: it is not an empirically testable theory. (2) as corollary to this, the theory lacks predictive quality. (3) the theory, actually, provides a "historical explanation" in scientific pretension: it is a historical hypothesis. As discussed, Popper argues for (3) in the *Objective Knowledge* and for (1) and (2) in the *Unended Quest*. The criterion of falsifiability seems essential here. The criterion is fundamental both for the formation of scientific knowledge and, whereby, for the formation of open society. Obviously, for Popper, the latter rests on the former. (2) simply follows from (1) and is the most palpable weakness of evolutionary theory. Admittedly, prediction is the most distinctive source of justification for science: it accounts for why science is so valuable for human life. As Reichenbach puts it: "A mere

report of relations observed in the past cannot be called knowledge; if knowledge is to reveal objective relations of physical objects, it must include reliable predictions. A radical empiricism, therefore, denies the possibility of knowledge” (Reichenbach 1951: 89).

Even in this case, although the theory draws from the empirical facts at an extremely general framework which characteristically and inevitably evades strict scientific control, it is radically different from most of the classical metaphysical theories (including “creationism”) in that it does not contain an ‘a priori of life’, that is, an ontological model that sees from the above and posits the fundamentals of all reality.

Popper’s mature account of the evolutionary theory, as we have seen, runs opposed to such an assessment, which is found in his earlier perspective. But Popper does not provide a well-established account of his change of mind. His methodological concern to refine the theory, which he already had, as we discussed, prior to 1977 as well, seems now to be more engaged. He seems, on the one hand, to think that the heart of the theory, i.e the theory of natural selection, “is not strictly universal, though it seems to hold for a vast number of important cases” (Popper 1987 [1978]: 145), and that it is still a research program (albeit, replacing carefully the adjective “metaphysical” with “challenging”) (Popper 1987 [1978]:144), thus, by nature, it must be “fallible and tentative” (Popper 1987 [1978]: 142). (I wonder whether the evolutionary theorists are ready to accept such a conclusion.) He, on the other hand, seems to be convinced that evolutionary theory must be a case of perfect science. But, given Popperian strictures, how to account for this? Indeterminism (this quasi-Hegelian “metaphysical” idea) might be of some help, though not without costs. Would it be wise, after all, to employ a metaphysical thesis in order to bring support to the view that the evolutionary theory is not metaphysical at all?

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