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A Critique of the Constitutive Role of Truthlikeness in the Similarity Approach

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Abstract The similarity approach stands as a significant attempt to defend scientific realism from the attack of the pessimistic meta-induction. The strategy behind the similarity approach is to shift from an absolute notion of truth to the more flexible one of truthlikeness. Nonetheless, some authors are not satisfied with this attempt to defend realism and find that the notion of truthlikeness is not fully convincing. The aim of this paper is to analyze and understand the reasons of this dissatisfaction. Our thesis is that the dissatisfaction with the notion of truthlikeness concerns the double role that this notion plays within the similarity approach: This notion plays both a regulative role in the conception of theories and a constitutive one in their selection.

The similarity approach (Oddie 1986; Niiniluoto 1987) stands as one of the most significant examples of the attempts emerged within the realist epistemology to respond to the challenge of the pessimistic meta-induction (Laudan 1981). A key feature of the similarity approach is a sharp shift in the formulation of the notion of truth. As concisely put by Niiniluoto, the strategy has been to move from "the strict concept of truth" to the "more flexible notions of truthlikeness and approximate truth" (Niiniluoto 1997, p. 547).[1] After Popper's unsuccessful attempt (1963), the similarity approach has been intended to provide a systematized conceptualisation of the realist hypothesis that though scientific theories are typically false, their

[1] Niiniluoto makes a distinction between truthlikeness and approximate truth (Niiniluoto 1987, 1997, 1999).

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increasing success indicates an increasing degree of similarity to the true state of affairs. As we will see in the following, Niiniluoto's pivotal idea is to introduce an empirical estimate of the degree of truthlikeness, the expected verisimilitude, which is a *fallible*, though reliable, indicator of the genuine correspondence to truth (Niiniluoto 1999).

Some authors, among which Boyd (1984), Newton-Smith (1981) and Niiniluoto (1984a), thought that the shift in the understanding of the notion of truth could rescue the realist epistemology from the attack of the pessimistic meta-induction (Laudan 1981). Following Laudan's (1984b) critique of the cogency of the notion of truthlikeness, a stream of thought emerged according to which the shift has failed to provide a satisfactory answer and it remains an open question whether the increasing success of scientific theories indicates that they are closer to the truth.

The goal of this article is to disentangle the reasons why the notion of truthlikeness has been perceived as unsatisfactory to defend realism. In particular, we investigate the role that this notion plays within the similarity approach. The thesis that guides our work is that the difficulties with the notion of truthlikeness should be searched in the role that this notion plays within the similarity approach. Before illustrating our thesis, we will briefly consider the basic assumptions that underlie the similarity approach.

The similarity approach, as formulated by Niiniluoto (1987), is intended to provide a measure of how similar a description delivered by a scientific statement is to the true state of affairs. To this end, Niiniluoto introduces what he calls the *degree of truthlikeness*, $Tr(g, h_*)$, of a scientific statement g. The degree of truthlikeness measures the distance of g from the truth h_*. The notion of truthlikeness is a basic tool: it is adopted either directly or indirectly—through its empirical approximation, as we will see in the following—to set a goal for scientific investigation, to select a theory among rival ones, and also to explain the success of science. Truthlikeness is considered a goal in science: a scientific theory should provide a description that is somehow true of reality. Moreover, among rival theories, the similarity approach dictates that the one that should be selected is the one with the higher truthlikeness, that is, the one that is closer to the truth. Finally, the notion of truthlikeness is adopted to state that a new theory that is preferred to its predecessor represents a step toward truth and therefore a genuine progress.[2]

The similarity approach raises a major epistemological issue. It is what Niiniluoto calls the "epistemic problem of truthlikeness" (1987, p. 263). The truth h_*, to which a scientific statement tends, is typically unknown and the only measure that can be computed is an estimated degree of truthlikeness: the *expected verisimilitude* $ver(g/e)$, which is a fallible indicator of the *degree of truthlikeness* $Tr(g, h_*)$.[3] The expected verisimilitude $ver(g/e)$ indicates how close a statement g is

[2] Concerning the realist conception of progress, Niiniluoto points out that a realist does not need to affirm that "all actual steps of theory change in science have been and will be progressive". A realist can accept that "some steps in the development of science have been regressive". What characterizes the realist is that he believes that science is progressive *on the whole* (1999, p. 201).

[3] The need for the introduction of $ver(g/e)$ alongside $Tr(g, h_*)$ is clearly expressed by Niiniluoto in the following statement: "the realist needs a distinction between *real* and *estimated* success: the former is unknown, the latter is known and serves as an indicator of the former" (Niiniluoto 1999, p. 168).

to truth h_* on the basis of some empirical evidence e. The measure *ver* has therefore an empirical nature and is directly related to the success of the statement g. In this sense, *ver* allows one to select a theory and to evaluate its progressive character on the basis of empirical evidence. Consequently, the claim that a theory is truthlike, as it is successful, can be disconfirmed by further evidence. On the basis of this observation, Niiniluoto concludes that the problem of estimating the truthlikeness "is neither more nor less difficult than the traditional problem of induction" (1987, p. 263). The path from empirical success to the truthlikeness of a theory is thus a *fallible* one (Niiniluoto 1999). Although Niiniluoto confirms that no infallible path exists, he makes the very hypothesis that:

> successful theories have a high degree of estimated truthlikeness, and their continued success can be explained by the hypothesis that they in fact are close to the truth at least in the relevant aspects (Niiniluoto 1980, p. 448).

In other words, Niiniluoto regards the high degree of estimated truthlikeness of a theory as a reliable indicator of its genuine correspondence to reality. Yet, the co-variance between the empirical success and the truthlikeness is precisely what critics, such as for example Laudan (1981), consider as a questionable assumption. Indeed, the similarity approach defines the meaning of the statement *theory* t_2 *has a higher degree of truthlikeness than theory* t_1 and provides a method to estimate the degree of truthlikeness of a theory on the basis of empirical evidence. Nonetheless, it is controversial whether it supplies "a criterion that would epistemically warrant" (Laudan 1981, p. 31) that t_2 is genuinely more verisimilar than t_1. As stressed by Laudan (1981), the available historical evidence seems to indicate that the empirical success of theories does not guarantee either their genuine reference or their truthlikeness.

It is our opinion that the main issue here is to understand what role the notion of truthlikeness plays in Niiniluoto's approach. To this aim we find convenient to adopt Kant's distinction between notions playing a constitutive role and those playing a regulative role.[4] We wish to investigate whether truthlikeness plays a *constitutive* or a *regulative* role. More precisely, we wish to understand whether this notion conveys knowledge about empirical entities or it simply plays the role of motivating, inspiring, and guiding scientific research. In the terminology that we use in this paper, a notion plays a constitutive role if it is adopted as an ultimate criterion to select one out of two rival theories. On the other hand, a notion plays a regulative role if it is assumed and/or used as an inspiration in putting forward a theory, but it does not play then a role in its assessment. An example of a constitutive criterion in theory selection is the ability to pass a given empirical test. A typical example of a regulative principle is the uniformity of Nature: although it cannot be conclusively proved, it is more or less explicitly assumed whenever scientific predictions are made.

Within the similarity approach, and within the realist epistemology more in general, the notion of truthlikeness clearly plays a *constitutive* role. As clarified above, the conclusive criterion for preferring a theory t_2 to a theory t_1 is that t_2 better corresponds to reality. However, as Niiniluoto acknowledges, the genuine

[4] For an extensive analysis of Kant's distinction between constitutive and regulative principles see (Grier 2007).

correspondence to reality, measured by the function $Tr(g, h_*)$, "is not epistemic in any sense" (Niiniluoto 1984b, p. 607). Because we have access only to an estimated degree of truthlikeness, the expected verisimilitude *ver*, which cannot definitively guarantee the genuine truthlikeness, it is hard to see how truthlikeness can play the constitutive role that the similarity approach assigns to it.[5]

Arguing that truthlikeness could not play a constitutive role in theory selection does not mean denying that this notion can possibly play some role. In particular, it could well play the *regulative* role of stimulating scientific exploration. It could be stated that the notion of truthlikeness acts as a motivation for the scientific work and plays a role in the phase of a conception of a theory: before a newly conceived theory is empirically evaluated, a scientist anticipates that it is, in some sense, closer to truth than the current one. In this sense, truthlikeness can be seen as an abstract ideal that conveys the expectations on the properties of a scientific theory including, for instance, the expectation that it will represent a genuine progress. As stated by Niiniluoto *via* the axiological thesis: in a realist perspective, truthlikeness is "an important or essential goal of science" (Niiniluoto 1999, p. 160).

In his discourse, yet, Niiniluoto assigns to the notion of truthlikeness both a regulative role and a constitutive one. On the one hand, truthlikeness performs the function of a stimulus for science to continuously search for a more complete and correct account of reality. On the other hand, as clarified above, it plays a central role in the selection of scientific theories. In responding to Laudan's challenge, Niiniluoto justifies the adoption of the notion of truthlikeness for theory selection and, more in general, the validity of the inference from success to truthlikeness, by pointing out that:

> […] if we are fallibilists rather than skeptics we may admit that the realist provisional inference was warranted relative to the the available evidence e. With new evidence e' the situation has changed, since our new theory T' has a higher degree of estimated verisimilitude on e' than the old rejected theory T. This feature of gradually approaching to the truth by revising theories indicates that the "inference to the best explanation" is not infallible, but it does not prove it to be an unreasonable procedure for a fallibilist realist. Indeed, by present lights we can claim that the old theory T was not referring because we have reached the new theory T' by applying the same method with respect to the new evidence e' (Niiniluoto 1984b, p. 604).

In other words, Niiniluoto states that the estimate of the degree of truthlikeness of a theory is modified as new evidence is gathered and that it is reasonable to think that this procedure of revision determines a gradual approach toward the objective truth. As a consequence, it is rational to assign to the notion of truthlikeness a constitutive role in the empirical process of theory selection.[6]

[5] In the terminology adopted by Niiniluoto, the role played by *ver* is called *methodological* (Niiniluoto 1999).

[6] Barrett (2008) has recently provided an account of scientific progress that reverses the one provided within the similarity approach. Rather than defining what it is meant for a theory to be closer to truth than a rival one and then qualifying scientific progress as an evolution toward truth, he starts from the pragmatic assumption that science advances by eliminating errors and then, following Peirce (1877, 1878), he characterizes truth as a process of refinement of scientific theories *via* the elimination of error

In a nutshell, Niiniluoto presents truthlikeness both as an empirically revisable criterion and as an a priori, objective principle. On the one hand, the selection of a theory is decided on the basis of the empirical evidence and thus on the basis of an *a posteriori* criterion. On the other hand, this selection is justified on the basis of the *a priori* criterion of the actual closeness of the selected theory to the true structure of the world. Niiniluoto adopts the notion of truthlikeness both as an *a posteriori* and as an a priori criterion for two reasons: first, truthlikeness must be empirically revisable in order to respond to the challenge of the pessimistic meta-induction. Second, truthlikeness has to play the role of an a priori principle because no realist conception of science can be defended without the assumption that successful theories are, at least in the relevant aspects, actually close to the truth (Niiniluoto 1980).

The fact that truthlikeness is revisable does not seem to pose problems in a regulative context while it appears problematic in a constitutive one. The hypothesis that a theory really represents a step toward the objective truth can be safely invoked in a regulative sense: although this hypothesis is revisable and cannot be guaranteed once and for all, it can act as a stimulus in the creative phase of conception of new theories. On the contrary, problems emerge in a constitutive context since the fact that truthlikeness is revisable challenges the central tenet of the realist epistemology: it eventually threatens the idea that what drives the actual selection of a theory, among rival ones, is its a priori objective truthlikeness and thus its better correspondence to reality. Niiniluoto (1984a), as well as Hardin and Rosenberg (1982), have tried to get around this problem by conceding that many past successful theories that have been then rejected may have failed to refer while insisting that they were anyway approximately true of the world and empirically successful.[7] Yet, as pointed out by Laudan, it is difficult to see how the acquiescence "in the divorce of empirical success and referential presumption" (Laudan 1984a, p. 158) is compatible with the realist view of science, in which: (1) a theory is selected among rivals because it has a higher degree of truthlikeness and (2) a theory has a higher degree of truthlikeness than its rivals because it better corresponds to reality.

The notion of truthlikeness plays an important role in the explanation of the success of scientific theories and of the progress of science, which is a central concern for the realist. Niiniluoto argues that the truthlikeness of a theory explains its empirical success and he invokes a role for both the degree of truthlikeness *Tr* and for its empirical counterpart *ver*:

> My specific proposal here as a critical scientific realist is to use the concept of truthlikeness *Tr* to define an absolute concept of progress–and estimated

Footnote 6 continued
from our current best descriptions (Barrett 2008). Using our terminology, we could say that the elimination of errors plays in Barrett's approach a constitutive role: a theory is selected on the basis of the pragmatic principle that specific errors of past theories have been eliminated from the new theory.

[7] Niiniluoto (1999) has given the phlogiston theory as an historical example of a theory that is non-referring, but more truthlike than its predecessor. More precisely, Niiniluoto points out that this theory "made an improvement on earlier account of combustion by realizing that fire is not a substance (or element) but a process" (Niiniluoto 1999, p. 191).

> verisimilitude ver to define an evidence-related notion of estimated or evidential progress (Niiniluoto 1999, p. 201).

Nonetheless, turning truthlikeness into a revisable criterion and separating success from reference seems to reduce the appeal of the realist position: according to Laudan, conceding that "genuineness of reference is not a *conditio sine qua non* for empirical success" means to dissolve the distinctive character of the realist position and to undermine the realist claim that only scientific realism holds "an epistemology with some novel explanatory content" that is capable to explain why theories are successful (Laudan 1984a, p. 162).

As long as the truthlikeness of a theory plays a primary role in theory selection, it undergoes the empirical falsification and it challenges the key realist assumption that what drives the selection of a theory is its actual closeness to truth. This is why it appears that the claim that a theory is truthlike should be rather made only in a regulative sense and it should not play a role in the selection of the theory itself. Indeed, given that employing the notion of truthlikeness in a constitutive sense is problematic, one should resort to it only if this notion really makes a difference in the phase of theory selection. As we argue below, this is questionable.

Empirical success is the *conditio sine qua non* for selection: no theory is selected if it is not successful. In this sense, the estimated truthlikeness of a theory, being measured on the basis of the empirical success of the theory under analysis, qualifies as a possible criterion for theory selection. Nonetheless, a statement on the truthlikeness of a theory is not genuinely independent from a statement on the empirical success of the theory itself. The question is thus whether truthlikeness is essential for theory selection. A geometrical metaphor can help clarifying the point. If one has to select the largest of two cubes and he is given the length of the edges of both cubes, the information about the volume of the two cubes would not add new valuable knowledge. Indeed, the volume of the cubes can be computed knowing the length of their edges. The relationship between truthlikeness and empirical success is somehow similar to the relationship between volume and length of the edge in our metaphor: why should one invoke a role for truthlikeness in theory selection when the relevant and the decisive information needed is already conveyed by the empirical success of the theories under analysis? It sounds reasonable not to have truthlikeness involved in theory selection and avoid therefore the problems connected to its constitutive role.

In a regulative sense, an objective characterization of truthlikeness could be advocated without raising the above mentioned problems. Being an ideal, the truthlikeness of a theory has not to be tested and validated on the basis of empirical results: in a regulative context, truthlikeness does not depend on experiments and therefore on a subject that has to design, implement and analyze these experiments. In this sense, the objectivity of the truthlikeness is not under discussion. As sharply remarked by Peter Urbach, the question whether a scientific statement is true of the world or not is an "*objective* matter" (Urbach 1983, p. 274) and any interesting account of truthlikeness is necessarily associated with the feature of objectivity. As he notes, the notion of truthlikeness developed within the similarity approach does not fulfill the requirement of objectivity. First, the measure of the similarity between

the structure described by a scientific statement and the true structure of reality is relative to the available evidence e, as we have typically access to $ver(g/e)$ rather than to $Tr(g, h_*)$. Second, the properties that are considered relevant in the assessment of the verisimilitude between structures are "strongly influenced by our constitution, our language and culture" (Urbach 1983, p. 275). Niiniluoto is fully aware of this critique as he admits that a commonly raised objection against the similarity approach to verisimilitude is precisely that "it does not make verisimilitude completely objective or purely logical" (Niiniluoto 1984b, p. 609).

A key to understand this lack of objectivity is to observe that the notion of truthlikeness plays both a regulative and a constitutive role in the similarity approach. As pointed out by Urbach, the theory of truthlikeness proposed by Popper "was in the spirit of this requirement of objectivity" (Urbach 1983, p. 274). To this end, Popper clearly made a distinction between the regulative and the constitutive role of the notion of truthlikeness and he clarified that since "we have no criterion of truth" we are simply "guided by the idea of truth as a *regulative principle*"(Popper 1963, p. 226).[8]

If the ontological presumption of the genuine correspondence to reality enters in the empirical sphere and plays a constitutive role in the selection of a scientific theory, it looses its objective character and it is challenged by the pessimistic meta-induction. It looses its objective character because its assessment eventually depends on the evidence and on our intuition. As a consequence, it can be disconfirmed at any moment by new evidence and by a change in our attitude. On the contrary, intended regulatively, truthlikeness is not undermined by the pessimistic meta-induction. In this case, truthlikeness is an *ideal* that drives scientific research. Truthlikeness is not questioned by falsification because, as an ideal, it remains as such whatever counter-examples are gathered and whatever change of perspective we go through.

In short, a reasonable solution to protect truthlikeness from the pessimistic meta-induction is to give to it only a regulative role. The open question is whether the proponents of the similarity approach are ready to renounce to its constitutive role.

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[8] Popper insisted that truthlikeness is a regulative notion and "not an epistemological or an epistemic" (Popper 1963, p. 234) one. Notwithstandingly, Niiniluoto (1987) ascribes to Popper the idea that empirical corroboration is a fallible indicator of truthlikeness and that, therefore, truthlikeness can legitimately play a role in theory selection. Yet, Popper clarified that the guide for preferring a theory to another one is its degree of corroboration, and that this "is not a measure of its verisimilitude" (Popper 1972, p. 103) but it simply indicates how its verisimilitude *appears* at a given moment in time. Popper compared the "status of truth in the objective sense […] to that of a mountain peak usually wrapped in clouds" (Popper 1963, p. 226): it is impossible for the climber to know whether he has reached the summit because, in the clouds, he would not be able to distinguish it from a subsidiary peak. The summit is there but the the climber can recognize its "objective existence" at best in the negative, that is, when he realizes that he failed to reach it, like for instance "when he is turned back by an overhanging wall" (Popper 1963, p. 226). Coherently with his falsificationist position, Popper concluded that "if we are lucky, we may discover the falsity of some of our theories" (Popper 1963, p. 226), at most.

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