**Transient scientific knowledge: The reality-view approach**

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 **Abstract**

This paper argues that the combination of Scientific Realism and the Reality-View Approach, which can be seen as an extension of the former, has several interesting implications: We cannot know whether the most successful theory TS is identical to the Unknown Real Process (URP) that generates and explains worldly phenomena; even on the fortunate occasion that a successful theory TS is identical to URP, this fact cannot be known; as such, the knowledge provided by science is merely provisional. Nonetheless, it may be suggested that TS can approach high efficiency within its applicability-domain, i.e., the domain of phenomena for which TS purports to provide sufficient explanations.

1. **Scientific Realism and the “Reality-View Approach”**

There seems to be little agreement about what Scientific Realism amounts to. A variety of different positions fall under this same heading, which can be viewed from many different and opposing perspectives (e.g., Chakravartty, 2017; Psillos, 1999; Rowbottom, 2019; van Fraassen, 1980). Putting these differences to the side, as they are beyond the scope of this paper, I believe that Nola and Sankey (2007) have aptly described the core of the position in the following passages:

“Scientific realists maintain not only that the aim of science is truth, but pursuit of science does in fact give rise to truth about observable and unobservable dimensions of reality. Such a realist view has evident implications for the methodology of science. For if the pursuit of science gives rise to truth, it is presumably the methods employed by the scientists that are responsible for this achievement. But in this case the use of scientific methods must lead to truth, that is, they are truth-conductive.” (337).

“The core idea of realism is that there is a mind-independent world made up of items that have properties, enter into processes and stand in structural relations.” (339).

Considering this position, which holds that scientific theories approach reality and succeed in explaining both observed phenomena and unobserved phenomena (that are theoretically grounded and indirectly observed, e.g., the identification of charged particles within a bubble chamber), I believe that the position proposed here, The Reality-View Approach, is not only consistent with Scientific Realism but expands upon it. The Reality-View Approach is based on the following two fundamental assumptions:

1. Unknown Real Process (URP): All phenomena have an explanation that is based on the URP that represents some actual feature/process that is responsible for the occurrence of the observable phenomena. The concept of responsibility here at play has the status of generating and explaining said phenomena. For example, the investigated phenomenon may be a particular instance of a general law based on the URP, or the phenomenon may have a cause that is generated by some process/mechanism. That is, the concept of responsibility aims to answer the questions of ‘why’ and ‘how’ some phenomenon occurred. We may presume that the investigated phenomenon is generated and explained by a general, universal, URP that is actually responsible for all that occurs and evolves in the world, or by a coherent set of features/processes that are responsible for different kinds of phenomena.
2. Applicability-domain: Because the range of possible empirical observations is enormous (infinite), it is highly plausible that every scientific theory T limits its explanations to some applicability-domain that includes the set of phenomena it purports to explain. There are two possible reasons for the establishment of an applicability-domain. First, if the set of phenomena is enormous, indeed infinite, it would be very difficult to produce a theory that would provide an explanation of such a vast collection of occurrences. It is, therefore, more efficient to produce a series of different theories each of which deals with its own applicability-domain. Second (an argument that perhaps complements the first), scientists developing the scientific theories must restrict the domain of possible observations to a more limited domain that is relevant to T­1, because the human cognitive system is incapable of consciously addressing more than a limited amount of information.

I turn now to a detailed discussion of both assumptions.

* 1. **The Unknown Real Process (URP)**

As mentioned, I assume that the notion of the URP that is responsible for the occurrence and explanation of the observable phenomena does not conflict with the Reality-View Approach. First, according to this approach, the purpose of a scientific theory is to seek out the truth. It is reasonable to suggest that truth in the empirical sciences is the attempt to describe and explain some actual occurrence, i.e., the investigated phenomenon. In this respect, if we suppose that the occurrence of every phenomenon has an actual cause, we can propose that the URP is a general name for the feature/process/mechanism that scientists attempt to discover, which is responsible for the investigated phenomena. Personally, as a cognitive psychologist who studies facial awareness and recognition, I can say that when attempting to provide an explanation for some facial phenomenon I find myself asking, what is the actual feature or process within the cognitive-brain system that is responsible for the occurrence of the phenomenon? Generally, then, I believe that scientists attempt to understand the investigated phenomenon by discovering the actual feature/process that is responsible for it, and they propose a hypothesis, a model, or a theory that they believe approaches this feature/process, that is the URP.

Second, considering that one of the central purposes of scientific research is to *understand* nature, where such understanding is grounded in scientific explanation (see Rakover, 2018, Author, under review; Salmon, 1990), we may suggest that the purpose of theories in science is to explain as accurately as possible the URP that is responsible for the phenomenon under investigation. Apparently, each research domain has an explanatory procedure (model) that is appropriate to it (see Rakover, 2018, Author, under review; Salmon, 1990). For example, Hempel’s (1965, 1966) model is appropriate to classical physics. To explain the empirical observation that a steel ball (B) at free-fall descends 4.9 meters in the first second, we utilize the Deductive-Nomological model according to which from two pieces of information, Galileo’s law and time being equal to 1 second, we can mathematically derive the extent of the fall, namely 4.9 meters. Given these pieces of information we can argue that the explanation of the specific observation of (B) shows that its behavior is but a particular instance of Galileo’s law (which can be inferred from Newton’s law), and that, in fact, any body under the same conditions can be expected to behave in the same way as the steel ball. That is, the explanation of the steel ball’s fall by appeal to Galileo’s law, which is based on the gravitational force between different bodies (in our case, Earth and the steel ball), is nothing more than a particular instantiation of a pattern of explanation of similar phenomena under similar conditions.

In the biological sciences the most appropriate approach is that of the New Mechanists (e.g., Bechtel, 2009; Craver and James, 2019; Machamer, Darden and Craver, 2000; Rakover, 2018). According to this approach, an empirical phenomenon is explained by describing a particular mechanism, which is composed of certain components with certain activities that engage in certain causal interactions, such that the mechanism as a whole produces, grounds, or supports the observed phenomenon. For example, the prevalent explanation of cases in which a person forgets a seven-digit-long number (within around 20 seconds) is provided by describing an information processing mechanism, analogous to the operation of a computer, that is based on a distinction between short-term memory (STM) and long-term memory (LTM). While STM stores very limited pieces of information for a short amount of time, LTM stores a great deal of information for the duration of a person’s lifetime.

We can see that both of these approaches to explanation attempt to discover the actual system in nature that is responsible for the occurrence of the investigated phenomenon. The D-N model is based on a law or general theory that addresses the investigated phenomenon along with similar phenomena. Without the presumption of such a law or theory, it would not be possible to explain the investigated phenomenon as a particular instance of a general law, as a phenomenon that is to be expected under the given conditions. The New Mechanists’ approach is based on the discovery of the mechanism that describes how the investigated phenomenon is generated by this mechanism. Without presupposing such a mechanism, it would be impossible to provide a description of how the investigated phenomenon was generated. Based on these two examples, we can suggest that an explanation of the investigated phenomenon is grounded in an attempt to describe a law, a process/mechanism, that is, to describe the URP that is responsible for the generation of the phenomenon in question.

* 1. **The Applicability-Domain**

The Reality-View Approach is not in tension with the central aims of Scientific Realism (searching and discovering truth). Rather, it constrains the explanatory power of scientific theory T within certain empirical limits within its applicability-domain. The theory purports to provide a sufficient explanation for any phenomenon within these limits. For example, Newtonian physics explains the free fall behavior of bodies as well as other phenomena pertaining to the motion of bodies on Earth and beyond. Therefore, I suppose that every theory, T, has a clear aim, which is to understand the investigated phenomenon and similar ones, by establishing an applicability-domain within which T purports to explain any phenomenon.

It is difficult to outline the applicability-domain of T in advance because the domain shifts with the advancement of empirical science. Nonetheless, we can suppose that the applicability-domain is influenced by the following factors: a) the range of values of T’s dependent and independent variables; b) the fundamental concepts upon which the theory is developed. For example, in Newtonian physics these fundamental concepts include constant space and time, and in cognitive theories of facial perception the fundamental concepts are drawn from the computer analogy; c) the empirical phenomena that are similar to the investigated phenomenon (the question of how similarity may be determined is difficult, as the similarity between different phenomena may be determined by the explanations provided by T); d) empirical observations that are found to be beyond the explanatory powers of T (see illustration in figure 1).

As mentioned, the simple assumption concerning the relation between T and its applicability-domain is that T purports to provide an explanation for all phenomena within this domain. As we shall presently see, this assumption may be falsified with further research. For example, it turned out that Newtonian physics was limited to the domain of Earthly speeds and fails as bodies approach the speed of light. We can thus argue that the applicability-domain of Newtonian physics is limited by specific speeds. As another example I will briefly describe the ‘perceptual model’ of facial recognition and point to where it fails. Rakover and Cahlon (1989, 2001) developed the perceptual model on the basis of witness memory. The standard procedure for facial recognition is based on the extent to which parts of some target face (e.g., the face of the defendant) matches parts of the face in the witness’s memory (e.g., the witness may be asked to pick out a pair of eyes that is the most similar to the defendant’s from a large collection of different eyes). This procedure places a heavy load on memory. In contrast, according to the perceptual model, the witness is asked to pick the face most similar to the target face from a test pair of complete faces (research shows that faces are remembered as complete units). The model shows that, when enough test pairs are presented, it is possible to reconstruct the target face by applying the rule that the contours of the target face must appear most frequently in the chosen test faces. Relying on this model, Rakover and Cahlon provide a mathematical proof that the target face can be fully recovered. Yet a challenge arises: facial recognition severely deteriorates when the number of test pairs is high. Exposure to many different test faces results in a retroactive disruption of facial memory. This is an extremely significant factor that was ignored by the model. The mathematical proof of the model’s successful identification of target faces was carried out while completely ignoring the disruptive effects of exposure to test faces.

The present concept, ‘applicability-domain’, is similar in certain respects to the concept of ‘scope’ or ‘unification’, which marks a theoretical virtue of scientific theories. For example, Keas (2018), whose paper summarizes and discusses the rich literature on the subject say:

“A unified theory, however, is one that explains *more kinds of facts* than rival theories with the *same* amount of theoretical content. … Simplicity is increased informativeness by means of a comparative *reduction* (relative to rival theories) of theoretical content. Unification is increased informativeness by means of comparative *increase* in the different kinds of data that get explained.” (2775).

The central differences between the present account and the appeal to theoretical virtues are as follows. First, while the Reality-View Approach considers a theory’s success to be an immediate and concrete expression of the realization of the aim of scientific research, i.e., to understand the world by providing a scientific explanation that reflects reality, Keas (2018) thinks of the notion of scope/unification as an aesthetic quality of a scientific theory – a quality that complements that of simplicity. Furthermore, according to the present account, the applicability-domain is a result of the difficulty to explain all possible observations (an infinite number of them, in fact), so that T must be limited to the explanation of only a certain set of phenomena within its applicability-domain. To illustrate this point, consider the following clear and simple examples. It is difficult to imagine that Freud’s theory of personality could explain the movement of bodies on Earth and in space or that it could explain chemical reactions. Conversely, it is very difficult to see how Galileo’s law concerning the free fall of bodies could explain Pavlovian learning.

* 1. **The ‘Theoretical-Success’ rule and the Understanding-Distance (UD) index**

If we accept that the goal of science is to increase our understanding of the world, we can propose a theoretical index, based on the Reality-View Approach, that estimates the degree of understanding as a function of scientific progress: the more T approaches the URP, the greater is such understanding (for other indexes of scientific advancement see Niinilouto 2019). This index is a theoretical expression of the degree of understanding, and the distance to full understanding, by the degree to which T approaches the URP:

Understanding-Distance (UD) index = f(T – URP)

The main method for evaluating f in the UD index is by experimentation and observation. The index relies on a fundamental decision rule, the ‘theory-success’ rule, which is based on the confirmation/refutation of the predictions of T in relation to other theories: the successful theory TS is to be preferred over the unsuccessful TUS when observations confirm TS and refute TUS or when TS is able to explain certain phenomena that TUS cannot. (The distinction here is between cases in which the two theories deliver different predictions under the same conditions and cases in which one theory is capable of explaining certain phenomena that are outside of the applicability-domain of the other.) Utilizing the theory-success rule brings TS closer to the URP in that by selecting TS other less empirically successful theories are removed from consideration. This is a kind of progress that can be characterized as minimizing error. In this respect, it may be suggested that the theory-success rule is a necessary but not sufficient condition on a theory’s approaching URP. Why? Because, if it is impossible for the URP to provide an incorrect explanation of some investigated phenomenon, then it is also impossible that TS, which is closer than TUS to the URP, provides an incorrect explanation of the phenomenon while TUS provides the correct explanation. Similarly, the UD index is also only a necessary condition, because if UD index ≠ 0 it follows that TS is distinct from the URP, yet if within the applicability-domain of T­S UD index = 0 it does not follow that T­s­ is identical to the URP, because such identity holds only within the applicability-domain (see figure 1, which illustrates this point).

Because the URP generates the investigated phenomenon and serves as its ultimate explanation, we can propose that a successful theory T­S, which predicts a great number of phenomena, is closer to the URP than an unsuccessful theory T­US, which predicts a smaller number of phenomena. This is so because the phenomena predicted by TS are those predicted/explained by the URP. Similar ideas have been suggested by other researchers. For example, Popper (1972) says:

"And if we fail to refute the new theory, especially in the fields in which its predecessor has been refuted, then we can claim this as one of the objective reasons for *the conjecture that the new theory is a better approximation to the truth than the old theory*" (81; emphasis in the original).

Another example comes from Godfrey-Smith (2008):

“The strategy employed by science would be, at any point, to use data to show that T1 is better than T2, where the hope is that this fallibly indicates that T1 is closer to the truth than T2. (146).

The central difference between the present account and these earlier ideas can be summarized as follows: The Reality-View Approach suggests that we should prefer the successful TS over the refuted theory, the unsuccessful TUS because the greater the number of successful predictions within the applicability-domain of TS the greater the overlap between TS and the occurrences/predictions generated by the URP. However, it is impossible to know the extent to which TS has approached the URP, as the URP is unknown, and the distance of TS from the URP is only in relation to competing unsuccessful alternative theories. We might say that T­S is closer to the URP than competing theories but no more than that. In other words, the present account cannot estimate the extent to which the distance in understanding has diminished between TS and the URP, because the nature of the URP is unknown. What can be proposed is merely that T­S is closer to the URP than less successful theories, but without knowing how close T­s is to the URP.

1. **Some significant conclusions from the Reality-View Approach**

According to this approach, the purpose of scientific research is to understand nature by uncovering the URP that provides the ultimate explanation of the investigated phenomena. This is achieved by suggesting hypotheses, models, and theories that attempt to explain these phenomena within the applicability-domains of theory and scientific research. The approach does not conflict with Scientific Realism, because according to this approach the purpose of research is the ‘truth’, and so the URP can be set as the empirical truth (that is, the URP is the truth that scientific research seeks).

Of course, the immediate question is: Does the process of scientific research actually lead to the eventual discovery of the URP, that is, to a theory T that is an accurate description of the URP? For the following reasons, my answer is neither completely positive nor completely negative. The methodological rule, the theory-success rule, most fundamentally (and without considering the theoretical virtues by which theoretical properties of different scientific theories can be characterized, see Keas 2018) selects the most successful theory from among competing theories. The question is: Does this rule necessarily result in greater proximity to the URP?[[1]](#footnote-1)

It is clear that if T under condition S predicts P, and if the URP under the same condition S generates phenomenon O, when O=P, it does not follow that T is indeed an accurate description of the URP. This conclusion remains true even if we find that a great number of T’s predictions are identical to the phenomena generated by the URP. This is because for any series of outcomes it is possible to match infinitely many functions, that is, theories that under the same conditions will produce the same predictions (e.g., Laudan and Lepin, 1991; Nola and Sankey, 2007). But then in what sense does this methodological rule, the theory-success rule, advance us toward the discovery of the URP? In answering this question, we must consider the immense number of possible observations and the applicability-domain of T.

Considering the number of possible observations, we can safely say that the process of scientific research will never reach the URP, that is, a complete understanding such that UD index = 0. After all, the range of possible observations is infinite and, as such, there always remains the possibility of some future observations that will be inconsistent with the predictions of the theory in question.[[2]](#footnote-2)

For these reasons, not only will we never discover the truth, that is, the URP, but even if by some chance we happen upon a theory that is identical to the URP we will have no way of determining that the purpose of scientific research has been realized – that the URP has been discovered. All that would be possible for us is to continue to hold the theory and test it over and over again; tests that the theory will successfully pass.

As noted, every theory defines a special range of phenomena to which it applies. For example, to explain the facial inversion effect, according to which recognition of an upright face is much better than of an inverted face (chin on top and hair below), the theory defines an applicability-domain that is centered around two important kinds of facial information: facial features (featural information) and the spatial relations between them (configural information) (e.g., Rakover and Chalon, 2001). We can therefore propose that a theory cannot explain all possible observations, that is an infinite number of empirical observations, and so must, practically, limit this immense number of observations to a narrow range to which it can apply and for which it can provide explanations.

In these respects, the answer to the above question is as follows: The successful scientific theories provide explanations to a range of empirical phenomena within their applicability-domains. Thus, as can be seen in figure 1, in the good case we can suggest the existence of a partial overlap between the predictions of the URP (the empirical truth) and the predictions of T within its applicability-domain (see in figure 1 the range of X’s in which the functions overlap). However, beyond this domain T fails and no longer matches the predictions of the URP that is responsible for the occurrence of the investigated phenomenon.



**Figure1**: Y-values as a function of X-values and of two hypothetical theories: the URP and T. The URP-curve represents the URP’s predictions of the real occurrences created by the URP; the T-curve represents T’s predictions. X1 …X4 represent four different experiments in the order in which they were performed. As can be seen, for X1 …X3 the two theories give very similar predictions (and therefore this similarity represents the applicability-domain), while for X4 the predictions are very different.

1. **Discussion**

In the discussion, I will focus on the following three comments, which are central to the main thesis of the paper.

* 1. **Underdetermination**

Let me first explain what counts as underdetermination. As Psillos (1999, 164) says about the Underdetermination of Theories by Evidence (UTE):

“UTE rests on two premises: (a) The *empirical equivalence thesis* (EET): for any theory T and any body of observational evidence E, there is another theory T’ such that T and T’ are empirically equivalent in respect of E; and (b) the *entailment thesis* (ET): the entailment of evidence is the only epistemic constraint on the confirmation of a theory.”

Focusing on this definition of UTE, could we claim that T amounts to an empirically equivalent theory to the URP? If such a proposal is possible, scientific methodology is in an embarrassing state, a state of underdetermination. Why? Because, if we accept that T is empirically equivalent to the URP, it follows that we can declare any T that successfully predicts/explains one observation or more that it is the URP, the real feature/process in the world. Yet this is not the case. It is impossible to accept T as empirically equivalent to the URP simply because we do not know the nature of the URP. As we shall see with the following example, a condition on proposing an equivalent theory T’ for T, we must be very familiar with T (see van Fraassen, 1980).

With the exception of the assumptions (a) that all direct and indirect observations are a result of the activity of the URP, and (b) that the URP can be approached by applying the scientific methodology for explaining/examining a theory (including by eliminating incorrect theories), we know nothing about the nature of the URP, the empirical truth that scientific research seeks to discover. For these reasons, we cannot accept the proposal that T constitutes an empirically equivalent theory to the URP. As can be seen in figure 1, we cannot accept the supposition that T is identical to the URP even though within a certain range the predictions of T are consistent with those of the URP.

One classic example of empirical equivalence is presented by van Fraassen (1980). He argues that it is possible to propose for Newtonian physics, TN, an empirically equivalent theory, TN­v, that is the conjunction of TN and the assumption that the entire Newtonian system moves at a certain constant speed, v. In this case, theories TN and TNv will make all of the same predictions. As a result, according to Scientific Realism, it is impossible to determine which of the theories is the real one; a problem that leads to the underdetermination of theories by evidence.[[3]](#footnote-3)

As can be expected, van Fraassen’s criticism of Scientific Realism has been met with many objections, including to this very example. For example, Acuña (2014) presented a physical argument that shows that, in actuality, TNv is not empirically equivalent to TN; and Laudan and Lepin (1991) suggested that, as science progresses, the proposed empirically equivalent theory may at a later time lose its equivalence status (see also a review of this topic in Stanford, 2017).

How does the Reality-View Approach address the threat of underdetermination of theories by evidence? If we begin from the assumption that the purpose of science is to understand different worldly occurrences by developing theories that progressively approach the URP, theories that manage to explain more and more phenomena (that is, theories that successfully expand their applicability-domain), it follows that constructing an empirically equivalent theory T’ does not constitute a threat but is an integral part of the research process. As long as T’ manages to provide a good understanding of nature, at least to the same degree as T, the present approach can accept it as a legitimate candidate in the attempt to discover the URP. This is because the research process may, in future, determine which of T or T’ is more adequate. In fact, the Reality-View Approach claims that there are two possibilities regarding T’: a) T’ adds nothing to the development of scientific knowledge, because it is nothing more than a theory that was tailor-made for the set of phenomena explained by T, that is T’ is nothing but an ad hoc theory, or b) T’ advances scientific knowledge and is therefore interesting, important, and is not ad hoc. If (a) turns out to be true about T’, the theory will be forgotten, like many other theories before it that have been found useless and were replaced by other, better, theories. Yet, if (b) turns out to be true of T’, the theory will continue to contribute significantly to the advancement of science and will be considered of great scientific value.

* 1. **Truthlikeness**

As can be seen, the Reality-View Approach is grounded in the fundamental idea that scientific theories attempt to approach a description of the URP. This position can be grasped using the general methodological framework by which scientific theories (which have or have not yet been refuted) are ranked according to their proximity to truth. In a broad review of the topic, Oddie (2016) presents a number of proposals for the evaluation of a scientific theory’s proximity to truth, beginning with Popper’s (1963) important work (see also the discussion in Rakover, 1990). Compared to the positions described in Oddie (2016) the present account suggests that a theory’s proximity to the URP can be estimated by the theory-success rule and the UD index, which is based on this rule. As mentioned, the theory-success rule is a necessary but not sufficient condition for the theory to approach the URP. Even supposing that T1 is selected as the closest theory to the URP according to the theory-success rule (T1­ ­has yet to be refuted), it does not follow that in the future a different theory Tx will not be selected as closer to the URP.

If the URP is unknown, how can we accept the theory-success rule (and the UD index) as supporting a theory’s approaching it, the unknown? If indeed the URP is completely unknown, it follows that there is no standard that will allow even a coarse-grained estimation of an approach toward the unknown. The answer to this question is that such a coarse-grained estimation is in fact possible. The presupposition of the URP hints at a way of carrying out a coarse estimation of T’s proximity to the URP. The presupposition is that the URP is the actual generator of the investigated phenomena and that it can be utilized to provide ultimate predictions/explanations of these phenomena. Adding the fact that every series of data can be matched to many different functions, and the following idea arises: successful prediction of a number of empirical phenomena by theory T overlap with the occurrences and explanations/predictions made by the URP. Given this situation, we can say, as it was suggested above, that the theory-success rule and the UD index allow us to rank different theories according to their proximity to the URP. Among the different theories that aim to explain the same empirical phenomena, the most successful one is also the closest to the URP. At this point we must note that utilizing the rule and the index require the following comments:

1. The applicability-domains of T and of other theories that compete for the explanation of the investigated phenomena must overlap a great deal. This is so because if, for example, the applicability-domain of some theory T\* is limited and only slightly overlaps with the rest of the applicability-domains, the following situation might arise: T\* would be able to provide explanations only to a small portion of the phenomena that are included in the applicability-domains of the other theories, and therefore, in relation to those other theories, its proximity to the URP will be hindered.
2. To compare the proximity of different theories to the URP we must rank the (theoretical and empirical) significance of the investigated phenomena (observations, experimental results). Without such a ranking we may find ourselves in a situation where T1, which explains a large amount of moderately significant phenomena, is preferred over T2, which explains a smaller number of phenomena but of much greater significance. Given that it is very difficult to rank the significance of the investigated phenomena, I make the following, partial, suggestion: the question of which theory is closer to the URP will be asked in relation to those empirical situations in which observations or experiments are made. In this case, the significance of the investigated phenomenon will be held constant and the theory that has yet to be refuted will be preferred over the one that has been.
3. T’s proximity to the URP is based on one criterion only – the degree of T’s empirical success in prediction and explanation. In this respect, we can continue to utilize T even if it has been refuted, so long as its efficiency within its applicability-domain is high. For example, no one would choose to use Einstein’s theory of general relativity to construct complex calculations of the motions of bodies on Earth; rather, they would utilize Newton’s theory and its various developments, even though it has been refuted.
	1. **Scientific progress**

The literature raises a very difficult question: does science progress (e.g., Niiniluoto, 2019)? The answer provided above by the Reality-View Approach is affirmative. But here I wish to point out a caveat. One of the strongest supporting arguments for Scientific Realism is the ‘no miracle’ argument, according to which the success of science (the natural sciences, particularly) is so great that if we do not take such success as evidence that science approaches a correct description/explanation of the world we will be forced to view such success as a miracle – something that no one can accept (e.g., Psillos 1999; Putnam 1975). How does the present account deal with this argument? Given that it can be seen as an extension of Scientific Realism, it must endorse the no-miracle argument. The difficulty is that if the Reality-View Approach accepts this argument, it will be difficult to understand the conclusion that, according to this approach, it is impossible to evaluate the degree to which TS approached the URP and we cannot know if some lucky theory that is identical to the URP actually arrived at the truth. My solution to the no-miracle argument is as follows: the claims that scientific success is no miracle and that TS nears a description of reality are correct, but only within its applicability-domain. This is so, because TS succeeds in predicting and explaining the phenomena within its applicability-domain and because these predictions are identical to the phenomena that were generated and explained by the URP within this domain.

This answer relies on the main conclusions of the present account:

First, the proximity of TS to the URP (that is, the real feature/process that generates and explains the enormous, infinite, collection of natural phenomena) is in relation to other competing, and less successful, theories (which can also be ranked according to their success as more or less close to the URP);

Second, the UD index cannot be assessed because the URP is unknown and the number of possible empirical observations is enormous;

Third, within the applicability-domain of T­S the degree of overlap between the theory’s predictions and the occurrences and predictions of the URP is greatest relative to less successful competing theories.

With these characteristics in mind, we can say that the Reality-View Approach provides only a qualified answer to the question of scientific progress: we can suggest that, within its applicability-domain, TS does, indeed, approach the URP, yet this is no guarantee that such approach holds with respect to all other phenomena and possible empirical observations. Therefore, science develops and progresses by creating theories that are successful in their application-domains and by expanding these domains (of course, the discovery of new phenomena spurs the creation of new theories that will provide explanations within new applicability-domains).

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1. The theory-success rule deals with the selection of the most successful theory among several competing theories, and as such can be seen as a variation of Inference to the Best Explanation (IBE). In this respect it must be emphasized that IBE as an inductive method does not necessarily result in the true theory (e.g., Lipton 2005; Weintraub 2017). [↑](#footnote-ref-1)
2. Similar accounts can be found in the literature, for example, Godfrey-Smith (2008) says that: “…we can never believe, at any specific time, that we have found a theory that is *true*” (145). Popper (1972) believes that scientific research is a never-ending process, and that anyone who thinks they have reached the true theory, has in fact abandoned the game of science. [↑](#footnote-ref-2)
3. It should be noted that this example, which shows that Newtonian physics has an empirically equivalent theory, does not pose a challenge to the Constructive Empiricism developed by van Fraassen (1980) as an alternative to Scientific Realism. [↑](#footnote-ref-3)