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EXPLANATORY FAILURES OF RELATIVE REALISM

Abstract: Scientific realism (Putnam 1975; Psillos 1999) and relative realism (Mizrahi 2013) claim that successful scientific theories are approximately true and comparatively true, respectively. A theory is approximately true if and only if it is close to the truth. A theory is comparatively true if and only if it is closer to the truth than its competitors are. I argue that relative realism is more skeptical about the claims of science than it initially appears to be and that it can explain neither the success nor the failure of science. Hence, it is not a promising competitor to scientific realism.

Keywords: failure of science, relative realism, scientific realism, success of science

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1. Introduction

Scientists use the rule of inference called 'inference to the best explanation' (IBE) to establish their scientific theories. When theories compete with one another, scientists choose one of them on the grounds that it provides the best explanation of phenomena. For example, physicists rejected Newtonian mechanics and accepted Einsteinian mechanics on the grounds that the latter could explain the perihelion motion of Mercury whereas the former could not. Are we justified in believing that the best of the available rival theories is (approximately) true? The answer is "Yes," according to scientific realism (Putnam 1975; Psillos 1999). By contrast, the answer is "No," according to relative realism, an original position developed by Moti Mizrahi (2013).

This paper aims to demonstrate the explanatory failures of relative realism. In Section 2, I explicate what relative realism asserts and what motivates it. In Section 3, I disambiguate the phrase 'the success of science' and the phrase 'the failure of science.' In Sections 4, I argue that relative realism can explain neither the success nor the failure of science. In Section 5, I diagnose the fundamental problem with the relative realist explanation of the success of a theory. I also argue that relative realism does not meet the requirement that Mizrahi (2012) thinks scientific realism should meet. In Section 5, I anticipate and reply to a possible objection to my criticism against relative realism. The conclusion of this paper is that relative realism is not a viable competitor to scientific realism.

2. Relative Realism

According to relative realism, the best theory among available rival theories is *comparatively* true. To say that "T_1 is comparatively true is to say that T_1 is closer to the truth than competitors T_2, T_3, …, T_n" (Mizrahi 2013, p. 401). Comparative truth is a relative property. T_n is comparatively true with respect to T_{n+1} if T_{n+1} is further from the truth than T_n. And T_n is comparatively false with respect to T_{n-1} if T_{n-1} is closer to the truth than T_n. Thus, the same theory can be comparatively true or false, depending upon which rival theory it is compared with.

T_1 might be closer to the truth than its competitors even if it is far from the truth. In other words, T_1 might be comparatively true even if it is not even approximately true. This would happen when T_1 and its competitors are all completely false, but T_1 is *slightly*, as opposed to significantly, better than its competitors. To use an analogy, suppose that you and I are in Rome and that you are a step ahead of me in a marathon race from Rome to Milan. Of course, you are closer to Milan than I am, but you are still quite far from Milan. Similarly, T_1 is comparatively true, even if it is utterly false, provided that it is slightly closer to the truth than its competitors. Mizrahi accepts this possibility, saying, "T_1 is

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comparatively true, no matter how far from the truth T_1 is *absolutely speaking*" (2013, p. 401). Keep in mind that T_1 can be comparatively true while at the same time being completely false.

What motivates relative realism? It is the observation that "theory evaluation is comparative" (Mizrahi 2013, p. 394). The idea is that scientists can know whether T_1 is closer to the truth than T_2, T_3, …, T_n are, depending upon whether they have certain theoretical virtues such as simplicity, accuracy, fruitfulness, internal consistency, external consistency, broad scope, and the like. But they cannot know whether T_1 is close to the truth *simpliciter*. There is a significant difference between being *closer* to the truth and being *close* to the truth, as was noted in the previous paragraph. T_1 would be true if it is the best of every conceived rival as well as if a true theory falls in the range of the conceived rivals. The true theory, however, might lie in the range of unconceived rivals, and scientists cannot demonstrate the superiority of T_1 to the best of unconceived rivals. Therefore, scientists cannot conclude that T_1 is true.

I must point out that the starting point of relative realism throws a monkey wrench not only into the scientific realist's aspiration for true theories but also into the scientific antirealist's aspiration for empirically adequate theories, for it implies that scientists can tell which theory is *closer* to empirical adequacy than which other rival theories, but that they cannot tell whether a chosen theory is *close* to empirical adequacy. As Stathis Psillos points out (1997, p. 370), when theories compete with one another, empirically adequate theories may fall outside of the range of the considered rivals. Let me use Bas van Fraassen's example (1980, p. 46) to illustrate Psillos's point. Suppose that Newton's theory of motion is composed of the three laws of motion, the law of gravity, and the hypothesis that the universe is at absolute rest. It can compete with empirically equivalent rivals that claim that the universe moves at 10km/h, 20km/h, and so on with respect to absolute space. Newton's theory of motion and its rivals, although empirically equivalent, are all empirically inadequate. After all, none of them can explain such phenomena as the perihelion motion of Mercury. Thus, empirical equivalence does not entail empirical adequacy. With this point in mind, suppose that T_1 explains more phenomena than T_2. Can we conclude that T_1 is empirically adequate? The answer is "No." We can only say that T_1 is closer to empirical adequacy than T_2 is. There is a huge difference between being closer and being close to empirical adequacy. Suppose that T_1 and T_2 are far less than empirically adequate, i.e., that most of their observational consequences are false, but that T_1 is *slightly*, as opposed to significantly, closer to empirical adequacy than T_2 is. In such a case, T_1 is not close to empirical adequacy. Consequently, although T_1 is comparatively empirically adequate, it is not even approximately empirically adequate. They are all utterly empirically inadequate. Therefore, if Mizrahi is right that we can only compare competing theories, we can only get closer to empirically adequate theories without getting close to them.

Mizrahi calls his position 'relative realism' as opposed to 'relative antirealism' on the grounds that it enshrines "the realist's optimism about science's ability to get *closer* to the truth" (Mizrahi 2013, p. 402). The relative realist agrees with the scientific realist that the special theory of relativity, for example, is closer to the truth than the ether theory is. Unlike the scientific realist and the relative realist, a constructive empiricist would not say that science moves toward truths. He would rather say that science moves toward empirical adequacies. Therefore, relative realism is distinct from constructive empiricism.

My overall assessment of relative realism is that it is a unique position that is distinct from both scientific realism and scientific antirealism, according to which (most of) what a successful scientific theory says about observables is believable, but none of what it says about unobservables is believable. I note, however, that relative realism is closer to skepticism about the claims of science than scientific antirealism is. Skepticism in this context is the view that none of what science says about the world is believable. The relative realist believes that a theory is closer to the truth than its competitors, though he does not believe that it is close to the truth. It is not clear, therefore, on what grounds the relative realist can believe that a theory is approximately empirically adequate, i.e., that most of its observational consequences are true. It seems that he can only believe that it is comparatively empirically adequate, i.e., that it is closer to empirical adequacy than its competitors. Clearly, then, the relative realist is more skeptical about what science says about the world than the scientific antirealist.

3. Disambiguating

There are successful theories in current science. A successful theory is one that explains phenomena, makes true predictions, helps us manipulate things, and passes severe tests. Larry Laudan defines 'successful theory' as follows:

> ..we would say that a theory is successful if it makes substantially correct predictions, if it leads to efficacious interventions in the natural order, if it passes a battery of standard tests. (Laudan 1981, p. 23)

Some examples of successful theories are evolutionary theory, the special theory of relativity, the general theory of relativity, the kinetic theory of heat, the oxygen theory of combustion, and the germ theory of diseases. The general theory of relativity, for example, makes the true prediction that light bends near the sun. *Some* observational consequences of a successful theory are *known* to be true. Keep in mind that the success of a theory requires that *some* of its observational consequences should *turn out* to be true.

Two questions arise. First, why is a theory successful? Second, why do successful theories exist in current science? These two questions should not be conflated with each other. The first question is about the semantic property of a theory that enables it to be successful. It can be answered by picking out an appropriate semantic property. The second question is about the process by which we come to possess successful theories. It can be answered by depicting the selection process. As K. Brad Wray (2007, p. 83) notes, the phrase 'the success of science' is ambiguous. It means that a theory is successful, and that successful theories exist in current science.

The scientific realist explanation of the success of science proposed by Hilary Putnam (1975) and Psillos (1999) is an explanation of why a theory is successful. The scientific realist claims, for instance, that the general theory of relativity makes the novel prediction that black holes exist because the theory is approximately true. Its ability to predict such phenomena would be a miracle if it were completely false. This account of the success of science is called the 'no-miracles argument'. The idea is that the hypothesis that appeals to approximate truth is better than the hypothesis that appeals to miracles. Thus, the hypothesis that a theory is approximately true provides the best explanation of why it is successful.

In contrast, the selectionist explanation of the success of science suggested by van Fraassen (1980: 40) and Wray (2007, 2010) is an attempt to explain why successful theories exist today. The selectionist explanation asserts that successful theories exist today because successful ones survive and unsuccessful ones die. A scientist devises a theory and puts it to tests. If it passes tests, it is selected. If it fails tests, it is discarded. It is because of this winnowing process that successful theories exist in current science. Thus, the evolutionary process by which successful theories are kept and unsuccessful ones are abandoned is responsible for the existence of successful theories in current science. On this account, theories are similar to organisms in that superior ones tend to persist and inferior ones tend to perish.

The phrase 'the failure of science' needs to be disambiguated just like the phrase 'the success of science.' First, 'the failure of science' means that a scientific theory fails some tests. A scientist proposes a theory in a certain field of research. Unfortunately, it makes only false predictions. Such a theory is instrumentally useless and unsuccessful. Second, 'the failure of science' means that unsuccessful theories perish. Scientists reject unsuccessful theories, and as a result they disappear from the scientific community. Thus, the phrase 'the failure of science' has two meanings just like the phrase 'the success of science.'

Wray (2007, pp. 85-88; 2010, pp. 375-376) argues that selectionism is superior to scientific realism because the failure of science can be explained by selectionism but not by scientific realism. Park (2014a) criticizes Wray's argument and argues that scientific realism explains more phenomena in science than selectionism. Here I do not explore the debate between Wray and Park. I only adopt Wray's method of demonstrating the superiority of a philosophical theory to its rival philosophical theory, viz., by demonstrating that one theory has a broader explanatory scope than the other.

Now that the phrases ‘the success of science’ and ‘the failure of science’ have been clarified, we are ready to explore whether relative realism can explain the success and the failure of science. Since each of the two phrases has two different meanings, there are four phenomena that require explanation: Some theories are successful, some successful theories persist, some theories are unsuccessful, and unsuccessful theories perish. In the following sections, I argue that relative realism can explain none of these four phenomena.

4. Explanatory Failures

4.1. The Success and the Failure of a Theory

The general theory of relativity is successful in that it makes the novel predictions that light bends near the sun and that black holes exist in the universe. By contrast, the theory of cold fusion is unsuccessful. It was proposed by Fleischmann and Pons in the late 1980s. It asserts that nuclear energy can be created at room temperature. Other scientists, however, could not replicate their experiment, and as a result the theory was discredited. Two questions immediately arise: Why is the general theory of relativity successful? And why is the theory of cold fusion unsuccessful?

The scientific realist and the relative realist have different answers to these questions. The scientific realist’s answers are that the general theory of relativity is successful because it is approximately true and that the theory of cold fusion is unsuccessful because it is not even approximately true, i.e., because it wildly misrepresented an unobservable part of the world. In contrast, the relative realist’s answers are that the general theory of relativity is successful because it is comparatively true and that the theory of cold fusion is unsuccessful because it is comparatively false, i.e., it is further from the truth than its competitors. An interesting question is whether the scientific realist explanation and the relative realist explanation are tenable vis-à-vis Timothy Lyons’s method of attacking an explanation.

Lyons (2003) raises an interesting objection against the scientific realist explanation of the success of a theory. He argues that T’s truth cannot explain T’s success because “T’s truth does not even make it *likely* that T will succeed empirically” (Lyons 2003, p. 895). His idea is that a true theory is not likely to be successful unless it is conjoined with relevant auxiliary assumptions and technologies. In this paper I only adopt Lyons’s method of attacking an explanation in general, viz., disputing that an explanans makes its explanandum likely. Keep in mind that according to Lyons, an explanation is unacceptable unless its explanans makes its explanandum likely.

The scientific realist’s explanation of the success of a theory meets Lyons’s requirement of a good explanation. The realist’s explanans that a theory is approximately true makes likely the explanandum that the theory is successful. An approximately true theory misrepresents the world to some extent. Hence, it might be either empirically adequate or approximately empirically adequate (Park 2014b, p. 108). If all or most of what a theory says about observables is true, it is likely that some of them will turn out to be true, i.e., that it is successful. To use an analogy, if all or most crows are black, it is likely that some crows randomly picked out from the population of crows will be black. Hence, approximate truth is an adequate explanatory property for success.

The scientific realist’s explanation of the failure of a theory also survives Lyons’s criticism. If a theory is not even approximately true, most of what it says about unobservables and observables is false. If most of its observational consequences are false, it is likely that some of its observational consequences will turn out to be false, i.e., that it is unsuccessful. To use an analogy, if most crows are white, it is likely that some crows randomly picked out from the population of crows will be white. In short, the scientific realist’s explanans that a theory is utterly false makes likely the explanandum that it is unsuccessful.

In contrast, the relative realist’s explanation of the success of a theory does not meet Lyons’s requirement of a good explanation. It is disputable whether the relative realist’s explanans that a theory is comparatively true makes likely the explanandum that it is successful. Suppose that T_1 competes with T_2. T_1 is comparatively true, i.e., it is closer to the truth than T_2 is. Both T_1 and T_2,

however, are not even approximately true and not even approximately empirically adequate. Most of what they say about unobservables and observables is false. It is unlikely, then, that T_1 is successful. After all, if most of what T_1 says about observables is false, it is unlikely that some of what it says about observables will turn out to be true. Hence, comparative truth is an inadequate explanatory property for success.

The relative realist explanation of the failure of a theory does not survive Lyons's criticism either. It is doubtful that a comparatively false theory is likely to be unsuccessful. Suppose that T_1 competes with T_2. T_2 is comparatively false, i.e., it is further from the truth than T_1 is. Both T_2 and T_1, however, are approximately true and approximately empirically adequate. Most of what they say about unobservables is true, and hence all or most of what they say about observables is true. It is likely, then, that T_2 is successful. If most of the observational consequences of T_2 are true, it is likely that some of them will turn out to be true. Thus, it is doubtful whether the relative realist's explanans that a theory is comparatively false makes likely the explanandum that it is unsuccessful.

The relative realist's position contrasts with the scientific realist's position. The relative realist has the burden of showing that if a theory is comparatively true, it is likely to be successful, and that if a theory is comparatively false, it is likely to be unsuccessful. Unlike the relative realist, the scientific realist does not have a similar burden, for I have shown in this section how the scientific realist's explanantia that a theory is approximately true and completely false make likely the explananda that a theory is successful and unsuccessful.

4.2. The Survival and the Death of Theories

Successful theories, such as the general theory of relativity, exist in current science. Unsuccessful theories, such as the theory of cold fusion, do not exist in current science. Why do successful theories exist in current science? In other words, why do current scientists possess successful theories? Also, why don't unsuccessful theories persist in current science? To put it differently, why do they perish from the scientific community? In short, what process is responsible for the survival of successful theories and the death of unsuccessful theories?

The scientific realist and the relative realist have different answers to these questions. The scientific realist maintains that successful theories persist and unsuccessful theories perish because scientists accept approximately true theories and reject completely false theories. Thus, the process of retaining approximately true theories and discarding completely false theories is responsible for the survival of successful theories and the death of unsuccessful theories. In contrast, the relative realist asserts that successful theories persist and unsuccessful theories perish because scientists accept comparatively true theories and reject comparatively false theories. Thus, the process of retaining comparatively true theories and discarding comparatively false theories is responsible for the survival of successful theories and the death of unsuccessful theories. There is a substantial difference between the scientific realist account and the relative realist account. The scientific realist account affirms, while the relative realist account denies, that the selected theories are approximately true. An interesting question is whether both accounts satisfy Lyons's aforementioned requirement for a good explanation.

The scientific realist account meets the requirement. As we noted in Section 4.1., an approximately true theory is likely to be successful, and a completely false theory is likely to be unsuccessful. Thus, if scientists keep approximately true theories, it is likely that they will end up possessing successful theories. If scientists abandon completely false theories, it is likely that they will end up not possessing unsuccessful theories. Thus, the realist explanans that scientists accept approximately true theories and reject completely false theories makes likely the explanandum that successful theories exist and unsuccessful do not exist in current science.

In contrast, the relative realist account does not meet Lyons's requirement. As explicated in Section 4.1., a comparatively true theory might not even be approximately true or approximately empirically adequate. Most of what it says about unobservables and observables is false. Such a theory is not likely to be successful. Also, a comparatively false theory might be approximately true

and (approximately) empirically adequate. Most of what it says about unobservables and observables is true. Such a theory is likely to be successful. Therefore, it is doubtful whether the relative realist's explanans that scientists keep comparatively true theories and abandon comparatively false theories makes the explanandum likely that successful theories persist and unsuccessful theories perish from the scientific community.

As before, the relative realist's position contrasts with the scientific realist's position. The relative realist has the burden of showing that if scientists retain comparatively true theories, they are likely to have successful theories, and that if scientists discard comparatively false theories, they are likely not to have unsuccessful theories. Unlike the relative realist, the scientific realist does not have a similar burden, for I have shown in this section how the scientific realist's explanantia that scientists accept approximately true theories and reject completely false theories make likely the explananda that successful theories persist and unsuccessful ones perish.

4.3. Diagnosis

The problem of explaining the success and the failure of a theory in terms of its comparative truth and falsity can be seen in terms of the conditions under which a theory is successful. Recall that according to Laudan's definition of success, a theory would not be successful unless some of its observational consequences are known to be true. Many conditions must be satisfied for some observational consequences to be discovered to be true. Scientists should have relevant auxiliary assumptions, technologies, financial resources, and the like. Thus, a theory is successful or unsuccessful depending upon whether these conditions are met rather than upon whether it has a worse or a better competitor, i.e., not upon whether the theory is comparatively true or false. Therefore, it is wrong in the first place to invoke comparative truth and falsity to explain success and failure.

The problem of the relative realist explanation of the success and the failure of a theory can also be seen in the light of the fundamental difference between the notion of success and the notion of comparative truth. As Mizrahi (2013, p. 401) clearly states, comparative truth is a relative property. A theory is comparatively true or not, depending upon which rival theory it is compared with. Success and failure, on the other hand, are absolute properties in the sense that a theory is successful or unsuccessful independently of how it relates to its rival theories. Observational consequences of a theory can be known to be true irrespective of whether the theory has a worse or a better competitor. In general, it is wrong to explain an absolute property in terms of a relative property. For example, suppose that Tom is 180cm and John is 170cm. It is wrong to say that Tom is 180cm and John is 170cm because Tom is taller than John, but it is right to say that Tom is taller than John because Tom is 180cm and John is 170cm.

5. Independently Testable Predictions

Mizrahi (2012) claims that scientific realism is no better than what Jarrett Leplin (1987) calls 'surrealism' (surrogate for realism). Surrealism holds that a theory is successful because the world operates as if the theory were true. Mizrahi's contention is that both scientific realism and surrealism explain the success of a theory, but scientific realism "fails to yield independently testable predictions" (2012, p. 137). Scientific realism would be better than surrealism if it could predict phenomena that surrealism could not. But scientific realism does not make any such predictions. Therefore, scientific realism is not superior to surrealism.

It is an open question whether scientific realism makes independently testable *predictions* or not. But the present discussion on scientific realism shows that it might make new explanations. When Putnam (1975) proposed scientific realism as a hypothesis explaining the success of science, his intention was to explain only the success of a theory. He did not intend to explain why successful theories exist, why a theory is unsuccessful, or why some theories perish. It is beyond the scope of

this paper, however, to defend the scientific realist explanations of these four phenomena sketched in the previous sections.

An interesting question is whether relative realism makes independently testable predictions. I leave the task of answering this question to the relative realist. What this paper shows is that relative realism explains none of the aforementioned four phenomena, and that it is unlikely that it makes independently testable predictions, given that it is closer to skepticism than scientific antirealism is. If you only believe that successful theories are comparatively true, it is not clear what you can predict or explain. Therefore, relative realism is not a viable alternative to scientific realism.

6. Objection and Reply

The relative realist might admit that relative realism explains neither the success nor the failure of science because it is not clear that the relative realist explanantia make the success and the failure of science likely. He would, however, reject scientific realism, even if it can explain both the success and the failure of science. After all, he rejects IBE, for as Mizrahi puts it, "I do not think that one can infer realism from explanatory and/or aesthetic considerations" (2013, p. 405, note 5). The relative realist would not be impressed by the scientific realist who uses IBE to establish scientific realism. The scientific realist only begs the question against Mizrahi.

Let me make two critical comments about Mizrahi's rejection of IBE. First, my position in this paper is not that scientific realism is established but only that relative realism is not a promising rival to scientific realism because it can explain neither the success nor the failure of science. My point stands even if IBE is a dubious rule of inference.~~.~~ Even if he rejects IBE, he should accept my thesis that scientific realism is better than relative realism. Second, rejecting IBE comes with the following cost for Mizrahi. He claims that relative realism might be an attractive position to antirealists because it "seems to mesh nicely with the antirealist's favorite explanation of the success of science, namely, van Fraassen's selectionist explanation" (Mizrahi 2013, p. 403). The selectionist explanation holds that science is successful because successful theories survive and unsuccessful ones die. Mizrahi's contention is that the retained theories are comparatively true and that the discarded theories are comparatively false. Thus, on the relative realist account, successful theories exist today because comparatively true theories are selected and comparatively false theories are ousted. In my view, both Mizrahi and antirealists ought to reject van Fraassen's selectionist explanation because they reject IBE. Strictly speaking, the selectionist explanation is proposed as an alternative to the realist explanation. Van Fraassen does not claim that his explanation is better than the realist explanation. So he is not using IBE. But he is using what I call 'inference to an explanation' (IE). You are using IE when you infer to a hypothesis from phenomena without claiming that the hypothesis is better than its rival hypotheses. An important point is that IE is no better than IBE. So if IBE is an unjustified rule of inference, IE is all the more so. Thus, Mizrahi and antirealists ought to reject IE and hence van Fraassen's selectionist explanation. On their framework, the selectionist explanation, even if it is good, does not add weight to relative realism.

7. Conclusion

Many insightful criticisms against scientific realism have been raised in the literature. It is fair to turn them against relative realism, an alternative to scientific realism. This paper concerns the following three of them: First, the realist explanans, the approximate truth of a theory, does not make the explanandum, the success of the theory, likely (Lyons 2003). Second, selectionism has a broader explanatory scope than scientific realism (Wray 2007; Wray 2010). Third, scientific realism does not make independently testable predictions (Mizrahi 2012). If relative realism withstands these criticisms leveled at scientific realism, it would be a promising rival to scientific realism.

Relative realism, however, can explain neither the success nor the failure of science, because it is not clear that the relative realist explanantia make the explananda likely. Hence, the question does not

even arise whether relative realism makes independently testable predictions. It is unclear that relative realism can explain any phenomenon in science, given that a comparatively true theory might not even be approximately empirically adequate. Moreover, it is wrong in the first place to explain an absolute property in terms of a relative property.

A philosophical lesson from the present discussion on relative realism is that relative realism is closer to skepticism than it initially appears to be, despite its commitment to the scientific realist idea that science moves toward truths. The more skeptical you are, the less epistemic risk you run, but at the same time your theoretical resources become less explanatory and science becomes more mysterious to you. This philosophical point can be summed up in a simple sentence: Believe little, explain little.

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