STANFORD'S ANTIREALIST EXPLANATION OF THE SUCCESS OF SCIENCE[1]

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Despite all their quarreling, realists and antirealists agree that science is remarkably successful at making predictions. Some realists have claimed that this success is nothing other than empirical confirmation of the realist hypothesis that science is successful at developing an approximately true account of the world.

One articulation of this argument comes from Hilary Putnam in *Mathematics, Matter, and Method* and has since become well known as the "No Miracles Argument." He argued that if we are not justified in believing that scientific theories are true, then how else are we to explain their remarkable success? He argues that unless antirealists can formulate some other explanation, the success of science can only be miraculous. It is this challenge that P. Kyle Stanford takes up explicitly in his essay, *An Antirealist Explanation of the Success of Science*.[2]

In this paper I will analyze P. Kyle Stanford's antirealist explanation of the success of science. I will argue that there are metaphysical commitments implicit in Stanford's explanation that weaken his epistemic antirealism. I will explore several strategies Stanford could use to avoid this, but will conclude that these strategies are far less appealing. Ultimately, I believe that Stanford's epistemic antirealism fails to respect the antirealist maxim that justification stops at the limits of observation and is thus no more appealing than a cautious realism.

Realism and Antirealism

One could say that there are as many versions of realism as there are realists. The same could be said for antirealism, and thus for the distinction between the two views. Nevertheless, we can draw a useful enough distinction for the time being.

The central doctrine of contemporary antirealism has been agnosticism towards the unobservable parts of scientific theories. This view is supported by two main arguments. First, antirealists argue that

[1] Thanks to Michael Weisberg, Karen Detlefsen, and the editors of *The Dualist* for helpful comments on this paper.

[2] Stanford, P. Kyle, 1999, An Antirealist Explanation of the Success of Science, (Philosophy of Science, 67, June 2000, page 266-284)

there is an important epistemological significance to the distinction between the empirical parts of scientific theories and the theoretical parts such that one can never be justified in believing what cannot be observed. Thus we cannot assume that a theory's successful predictions imply the successful reference of its theoretical terms. Second, antirealists argue that because the history of science is littered with false theories that were successful, we cannot be justified in believing that our current successful theories are nonetheless true, or closer to the truth than past theories.

Realists, on the other hand, believe that such caution is unnecessary. They believe that no epistemological significance should be attached to the observational limits of human perception. They argue that scientific instruments–such as the microscope–extend the limits of perception and thereby add justification to the beliefs we have about entities that cannot be confirmed with the naked eye. Furthermore, they assert that we do have reason to believe that the predictive success of scientific theories does imply that they are approximately true, or at least that they are closer to the truth than past theories, even given the fact that many past theories were successful, yet false. Arguments in favor of this view range from appeals to the increases in predictive power, to more successful intervention, to the confirmation of the same belief from numerous scientific disciplines.

Realists need not be committed to believing that every current scientific theory that is successful is automatically true. In fact, a cautious realist might argue that we can appeal to science itself in order to sort out which scientific theories we should believe are true and which call for agnosticism. But even this very cautious form of realism will not satisfy the antirealist who will argue that appealing to contemporary science itself to make this distinction would beg the question, for it is precisely the epistemological status of science itself that is in question.

One of the consequences of antirealist caution is that only the observable parts of science can be analyzed in explaining the success of science. This is precisely what makes the No Miracles Argument so difficult for the antirealist. That is, the realist has the advantage in explaining the success of science because he can appeal to the true, while antirealists cannot. This is exactly the challenge that Stanford attempts to meet with his explanation of the success of science.

Stanford's Epistemic Antirealism

The Ptolemaic system of astronomy is a characteristic antirealist example of a theory that is just as predictively successful as the true theory, yet is demonstratively false. The Copernican system was only capable of making small advancements in predictive success over the Ptolemaic system, even though it marked a huge advancement in how

to think about celestial bodies.[3] This example is therefore often used by antirealists to challenge realists to explain the success of a false theory. Stanford's use of this example is meant to draw on what might be the most intuitive realist explanation for the success of a false theory in order to set up an analogy with his own explanation of the success of science.

Thus, he asks how it is that the Ptolemaic system of astronomy was able to make successful predictions even though the Copernican system clearly demonstrated that it was false. Stanford then suggests that we can say that the success of the Ptolemaic system can be explained by "pointing out how closely its predictions approximate those of the true Copernican hypothesis."[4] This example is meant to provide an analogy for understanding Stanford's own antirealist explanation of the success of science.

Stanford claims there are three components to epistemic antirealism. They are:

(1) A correspondence theory of truth.
(2) That there is always some true theory of a given scientific domain.
(3) That we are never in a position to know whether any theory we have discovered, tested, and/or applied is in fact the true theory.

Stanford begins his argument by claiming that he will "make things as difficult as possible for the antirealist"[5] by granting the realist two things that antirealists normally reject: first, the correspondence theory of truth, and second, the claim that for all domains of science it is *theoretically* possible to construct a true theory of that domain.

Given the lack of any qualifications, I take it that by (1) Stanford means a non-controversial version of the correspondence theory of truth in which a belief is true provided there exists a fact corresponding to it.

In (2) Stanford claims that in every scientific domain there is a true theory corresponding to it which could predict everything in that domain. As for what Stanford means by true theory, he says only that "what matters is that there are facts of the matter about the underlying mechanisms in the domains about which we theorize and that our theories (sometimes) make predictions that are (sufficiently) close to those made by the true accounts of the relevant mechanisms."[6] The bulk of my criticisms will involve an analysis of this second thesis.

[3] Ibid, p. 267

[4] Ibid, p. 273

[5] Ibid, p. 267

[6] Ibid, p. 275

These first two theses are a generalized form of the kind of relationship that Stanford meant to bring to our attention in the Ptolemaic/Copernican example. Thus let us make the theses more concrete by applying them to Stanford's example. We can then point out that in the Ptolemaic/Copernican example there is a true theory, the Copernican theory, to which the predictions of the Ptolemaic theory correspond.

In order to generalize this account to explain the success of science we must ignore the content and specifics of the Ptolemaic and Copernican systems and claim that for all scientific domains there is always a true theory that makes all the correct predictions about that particular domain. We can thereby explain any of our theories by their being predictively similar to that true theory, just as we had with the Ptolemaic system in relation to the true Copernican theory.

It is not quite accurate to say that this is a generalization of the relationship between the Ptolemaic and Copernican systems because there are inherent limitations to that example. These limitations are due to (3), which claims we can never know whether a theory we hold is true, no matter how predictively accurate. This is not *just* the claim that there will be no "end of science" in which we will have answered every question about the natural world – realists believe this as well. Instead, it is the further claim that empirical predictive success can never justify our belief in what is unobservable.

The analogy with the Copernican and Ptolemaic systems of astronomy ends because the example only works if we take the Copernican theory to be a stand-in for the true theory. The Ptolemaic/Copernican example is only a useful analogy in that it specifies the type of relationship between a false theory (Ptolemaic) and a true theory (Copernican) that Stanford will generalize to explain all scientific theories.

That relationship is: just as we explain the success of the Ptolemaic theory by its being predictively similar to the Copernican theory, so too we explain the success of our theories by their being *predictively similar* to the true theory of that same scientific domain. Instead of assigning truth to our scientific theories in order to explain success, we say that the more successful a theory, the more predictively similar it is to the true theory. Stanford writes, "The success of a given false theory in a particular domain is explained by the fact that its predictions are (sufficiently) close to those made by the true theoretical account of the relevant domain."[7]

This is Stanford's general argument. I will show that this explanation cannot remain fully epistemically agnostic about the

[7] Ibid, p. 275

unobservable world while also retaining a coherent account of (2).

Stanford & Other Antirealist Explanations

Stanford's paper provides insight into the problems that plague most antirealists as well as hope for a way out of that problem. The antirealist's difficulties in explaining the success of science stem in part from the fact that in explaining the success of that theory they can appeal only to the relationship between a theory and the world. For example, Bas van Fraassen explains the success of science by appealing to empirical adequacy, but Stanford notes that explaining "the success of a theory by appeal to its empirical adequacy is, in essence, to explain why some of the observational consequences of the theory are true by pointing out that all of its observational consequences are true."[8]

He notes that the problem antirealists find themselves in is that, because they are unwilling to talk about the metaphysical status of the entities posited by the theory, they can only praise the accuracy of a theory's predictions. Realists, on the other hand, are perfectly comfortable using the unobservable parts of the world to explain the success of the theory.[9]

In contrast, Stanford credits the success of his explanation to the fact that it appeals only to a relationship between two theories and avoids claims about the world altogether. Thus, unlike some of his fellow antirealists, he isn't forced into talking only of the empirical world or the theory in need of explanation. The success of his explanation can be attributed to two things: he has two theories to work with, not one, and he is able to speak of and use truth without attributing it to the theory he is explaining. These two are related in that the second theory brought in is the true theory to which our successful, yet ultimately false, theory is compared. The true, but unknowable, theory takes the burden of what to do with truth off the hands of the antirealist.

Explanations of success don't seem so hard when truth enters the formula, but for most antirealists talk of truth means that either the empirical world is as the theory described it or the theory is true. Stanford's explanation is meant to talk of truth without attributing it to either the theory being explained or the world it explains. In this explanation, the world that is described by the two theories almost disappears altogether, but, I will argue, not completely.

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[8] Ibid, p. 268

[9] Ibid, p. 276

Stathis Psillos's Criticism of Stanford

Among others attacking Stanford's ability to explain the success of science is Stathis Psillos. In his argument he challenges the legitimacy of Stanford's true theory. Psillos argues that given Stanford's use of a correspondence theory of truth, the true theory is identical to the scientific domain it describes. Because Stanford doesn't explain the difference between a theoretical account of the world and the world as it really is, the true theory must be taken to correspond to the world such that there is no difference between the true theory and the world. If Psillos is correct, then the structure that allows truth to explain the success of science without relying on the (approximate) correspondence between our theory and the world collapses, and Stanford is back in the position that he claimed his theory was capable of avoiding.[10]

I think that Stanford could provide an explanation as to the difference between the true theory and the world and thus save his argument. Stanford could appeal to his claim that our theories are being compared to the *predictions* of the true theory. In this case the true theory can be understood as something like the theory we would have at the end of science. We are comparing our theories to the true theories we would *theoretically* have at the end of science.

Let us explore this possible response by first noticing that predictions are not the types of things that are true about the world in the sense that the entities that theories posit are. Let us further notice the minimal logical relations that apply to theories such that they can make successful predictions. Thus, we could say that a successful prediction is only possible if, and only if, there is some true account of that same domain that implies that prediction.

Thus if, and only if, true theory *TT* correctly describes principle *p*, law *l*, entity *e*, etc., in domain *d*, can it imply that occurrence *O* will occur in location *L* at time *T*. The important point being made here is that theoretical *descriptions* must be understood as different from theoretical *predictions*. That is, it makes perfect sense to have a theory that describes some domain without thereby making predicts of that same domain, but we *cannot* have a theory that successfully predicts occurrences in some domain without also correctly describing that part of the domain that the predictions are true about.

This is a very simple understanding of a prediction, but the important part is not in the characterization of what counts as a prediction so much as what must be true of the world such that a theory can make correct predictions about it. I will use this basic analysis of

[10] Psillos, Stathis, 2000, *Predictive Similarity and the Success of Science: A Reply to Stanford*, (Philosophy of Science, 68, 3, Sept. 2001, 346-355)

predictions to argue that Stanford must make metaphysical assumptions in order to avoid Psillos's criticism.

Predictability

If we understand a prediction as that which is implied by the claims a theory makes about some scientific domain, then the success of that prediction depends upon whether the theory makes true claims about what exists in the world and how it operates. If the theory claims that entity *e* will follow regularity *r*, behave according to some principle *p*, or adhere to a law *l*, then the success of the prediction of the behavior of those same entities and regularities will depend upon whether that entity is actually regulated by those principles or laws.[11] If it were the case that the entities of some particular domain behaved erratically according to no regulative principles, no predictions could be possible.

In order for predictions to be possible, every occurrence in some particular domain need not be unified around one particular law, nor need these principles be true for all time. Nonetheless, the interaction between distinct principles as well as the change of one particular principle over time must occur according to other more general regulative principles which would allow those interactions or changes to be predicted.

It seems that under this interpretation Stanford's view must be that, while he can remain agnostic as to the particulars of scientific theories, he must be committed to some version of structural realism in which the structure of nature is taken to be regulative enough and uniform enough for the true theoretical account of that domain to imply correct predictions. This may be a surprising consequence given that antirealists traditionally claim that we cannot be justified in believing anything about the truth of the most theoretical and fundamental parts of scientific theories.

On the other hand, Stanford is certainly at liberty to claim that the true theory could simply be a description of every event in that scientific domain for all time without there being any determinate order to those events or any unifying mechanical principles.[12] But then Stanford has distanced the true theory from any notion of making predictions. Instead, the true theory is only God's list of all occurrences. I will take up this interpretation of (2) in the next section.

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[11] This is not an argument for the claim that success justifies belief in the approximate truth of our scientific theories.

[12] In fact, if causal skeptics are correct, that may be all *the true theory* ever could be.

Describability

Stanford is not bound to the claim that the true theory be anything like what we understand a theory to be. There are numerous other ways of interpreting his true theory. For instance, Stanford could claim that we explain the success of our theories by comparing them to the *description* of the true theory, rather than the *prediction*. In this case the true theory is the theoretical analog to the world at every location and at all times without reference to any principles, regularities, or laws.[13] It would be something similar to a giant list of happenings, none of which would have to be part of a general law-like structure. The true theories would only describe, not predict, a scientific domain at some particular point in time.

There are two problems with this strategy. First, Stanford puts such emphasis upon predictive similarity that describability would be inconsistent with his own writings. Second, true theories as descriptions of the world would certainly fall prey to Psillos's argument that there is no significant distinction between the true theory and the world.

It seems that there are only two other possible options for Stanford. First, he could argue that he need not make any claims about the form the true theory would take because it isn't something that could be known. Second, Stanford could argue that the true theory need not be descriptive or predictive, but could have some other structure and that, given our cognitive limitations, we might not even be able conceptualize models corresponding to nature's true structure.

Both of these arguments make important points about the limits to human knowledge and thus to the prospect of making any particular claims about the true theory, but this doesn't mean Stanford can avoid the challenges introduced by Psillos and me. Stanford's argument puts far too much weight on the true theory to claim that, because of (3), no particular claims can be made about the structure of the true theory.

Epistemic *Anti*realism?

I have argued that Stanford is committed to a form of structural realism. There is, of course, a lot of room to move along the spectrum from there-are-regularities-to-reality to there-is-a-permanent-immutable-structure-to-reality. Where Stanford would finally position himself I don't know, but I assume he would find the weaker claim completely adequate.

At this point the real question is to what degree this view can be considered antirealist. The problem with this question is that the distinction between realism and antirealism has proven to be quite porous, and Stanford has marked out a position as close to the middle

[13] Unless, of course, concepts such as causation of force turn out to be real entities.

as one can get. Thus, it will not do to mark off the battle lines and determine which side he is on given that those battle lines themselves are under dispute. Instead, I contend that in Stanford's attempt to meet the challenge of the No Miracles Argument, Stanford has conceded too much to the realist in order to retain anything particularly unique to antirealism.

The appeal of antirealism comes in the caution it demands toward beliefs that cannot be confirmed by direct observation. Realists would certainly find much to celebrate in these antirealist warnings. In fact, realists can remain cautious, but the criterion by which realists sort out those scientific beliefs and practices that are epistemologically sound from those that should come with warnings inevitably appeals to that which extends beyond the scope of what antirealists find justified. Antirealists cannot find comfort in any justificatory grounds that extends beyond the perceptual apparatuses that we find wired to our brains. Antirealists recognize that science is a clear attempt to extend beyond this limitation, but they don't believe that justification can be extended with it.

Thus, antirealism is distinct and appealing precisely due to that which they believe is the proper grounds for justification. Now I want to argue that Stanford's explanation for the success of science offers nothing novel or appealing to either side.

It is true that Stanford can remain agnostic as to the truth of any particular theory of the structure of nature, but his entire argument is built upon the view that whatever structure nature might have, it must be such that it can be captured within the minimal limits of the syntax of human cognition – as analyzed according to the structure of predictive and descriptive theories. It seems that in this case Stanford is not heeding the antirealist's warning to remain agnostic about the most fundamental and theoretical parts of scientific theories. Thus I believe an antirealist would insist that Stanford has conceded far too much to the realist and has ceased to respect the antirealist core claim that the observable/unobservable distinction is the main criterion for justification.

On the one hand, realists argue that science itself can advise us to withhold ascriptions of truth to scientific theories. On the other hand, they believe that science also justifies our ascriptions of truth to other scientific beliefs. Importantly, they argue that, because of testing holism, predictive success can justify not only semi-observables but also the deeply theoretical parts of science such as claims about the structure of the natural world.

I believe they would probably welcome Stanford's argument as one might welcome a new, but skeptical, adherent into a political organization. That is, they would reason that Stanford has loosened his

grip on the observable/unobservable distinction just enough that his insistence upon being agnostic as to one theory or the next is no problem. He will shortly be shown that science can provide justification for belief in scientific theories, just as the limits of the syntax of human cognition has justified belief in the structure of nature. Given this weak form of antirealism, there doesn't seem to be much of anything uniquely attractive about Stanford's position since selective agnosticism about scientific theories is available to the realist as well.

It is hard to see what the virtue of Stanford's epistemic antirealism is beyond simply demonstrating that one can explain the success of science without attributing truth to the theories that are successful. While Stanford may have provided an antirealist explanation with the hope that it would silence realists and rally antirealists, I argue that he has succeeded only at that – providing an antirealist explanation of the success of science, albeit not from a form of antirealism that antirealists would see as supportive of their cause or that realists would see as antagonistic.