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APPROXIMATE TRUTH

A Paraconsistent Account

1. INTRODUCTION

I think of myself as a realist, in at least two senses of that word. First, I (try to) face things as they are, rather than ignore evidence that the world is not unfolding as I would like it to. And second, I think that science aims and often succeeds at telling us how things are. The first sort of realism is generally regarded as a (practical) virtue—we are more likely to succeed if we work from true beliefs about the way things stand, than if we start with wishful thinking.[1] But the second is pretty controversial, and controversial for reasons related to the first: scientific realism, to many, is itself a bit of wishful thinking. It ignores various limits on our ability to know the world, on the notions of truth appropriate to our use of language, and the form that our scientific theories take.

This paper is part of a larger project, working towards a new version of scientific realism—one not so strong as to make me guilty of wishful thinking, nor so weak as to make me (really) a non-realist after all. The focus of this paper is on one of the central notions that many realists have appealed to: the very idea of approximate truth. For reasons that will emerge, on my account approximate truth turns out to require paraconsistent treatment.

2. REALISM: SOME ISSUES

2.1 Characterizing Realism

Characterizations of realism in the literature have generally fallen into two camps. Some give a prospective account, according to which the realist takes arriving at the truth to be the *aim* of scientific theorizing, while the anti-realist attributes more modest goals to science; others place the difference in the here and now, saying that realists take (some of) our best current theories to be *approximately* true, while anti-

[1] I should add, though, that there are some interesting issues here. Some recent studies have shown clinically depressed patients make more accurate predictions of what others will say about them when asked in confidence than normal controls do. Perhaps a certain amount of wishful thinking (on some topics, at any rate) is healthy rather than pathological.

J. Meheus (ed.), Inconsistency in Science, 81—103.

realists do not. I find the first approach unsatisfactory because it makes the difference purely prospective; realist and anti-realist could have the very same views about the status of current theories. Simply having the long run aim of truth leaves no *present* distinction between realists and (for example) constructive empiricists. A characterization of scientific realism that makes realism a live issue now, rather than a question about theories we do not have now, and may well never have, will need to describe a reserved, pro-tem form of commitment that is still realistic. And it must be such that, if realists are correct, we can reasonably make this commitment to (some) present theories. Approximate truth is one way of trying to characterize what such a commitment asserts about a theory.

But this approach to characterizing realism is also less than satisfactory: to date, we lack an adequate account of approximate truth—one that can explain the partial success of our current theories, that is recognizably related to the notion of fully-fledged truth, and that can be plausibly attributed to theories with all the imperfections the history of science suggests our current theories (very probably) suffer from.

One obvious criticism begins with the observation that what is "approximately true" is clearly *not* true. That is, we are not dealing with some kind of truth here, but rather with some kind of falsehood. So we must ask just what is gained, for the realist, by picking out a kind of falsehood and labeling it "approximate truth"? The immediate response is to say that we aim to pick out claims (or sets of claims) that, while false, nevertheless approach the truth, just as an ordinary measurement result, though false, still approaches the truth about the length of a board. But this appeal to a parallel with approximation in measurement is dubious.

In the case of a measurement we have a clear way of reporting the measurement result that respects the tension between precision and accuracy by allowing a margin of error (its size depending on the circumstances of the measurement and the required confidence level). The result is a trade off between precision and accuracy, which allows us to speak quite plainly about the result of the measurement being an approximation (i.e. falling within a certain distance) to the actual, precise (?) length of the object measured. We can also rank measurements as being better (or poorer) depending on the size of their margins of error (assuming, for now, no systematic error is involved in any of the methods being used).

Things are not nearly so clear with approximate truth. Approximate truth must deal with failures of conceptual fit, not merely lack of perfect accuracy and precision in a figure: the concept of "length" is not put in question by treating measurement results as only approximations to the actual length of an object, but when we speak of classical physics as approximately true, we recognize that the classical concept of "mass"—to choose a famous example—does not quite apply to the objects of the real world.

2.2 Observation and Theory

Another debate that plays an important role in this area arises from historical developments in philosophy of science. The surrender of a sharp analytic/synthetic distinction and the resulting demise of "meaning postulates" that had been meant to preserve a clear distinction between observational reports and theoretical assertions

have been a two-edged sword for realists. On one hand, it undermined empiricist views that had relied on arguments like those in "The Theoretician's Dilemma" (Hempel 1958) to defend the dispensability of all but instrumentalistic commitments to theory. After all, if we cannot even state our observations without making use of a theory's conceptual apparatus, how can we avoid making an implicit commitment to the correctness of whatever theory we use to frame our observations? But on the other hand, it raised problems for standard views of scientific progress: how can we fairly compare competing theories if we have no neutral observations against which to test them? Worse yet, as Feyerabend argued so forcefully, the notion that later theories somehow include the truths that earlier theories had captured now seemed untenable. Galileo's law of falling bodies is simply false in the Newtonian picture, since the acceleration due to gravity is not constant, after all. And in general, even when new theories allowed us to derive sentences that resembled those of earlier theories, the notion that the sentences somehow had the same meaning seemed to be indefensible; conceptual incommensurability ruled it out.

The need for a new account of observation was clear; one important candidate, due to Wilfrid Sellars (1963, 321f.) was the pragmatic theory of observation. This view accepts that observations are made using the conceptual resources of the theoretical language. In outline, the theory holds that human beings have a capacity to respond to various events or conditions in their environment with reports or descriptions, but the conceptual resources they use to make such reports are a product of linguistic training, not an in-built, fixed set of basic observational concepts. On Sellar's account, as we acquire a language we learn to make "language-entry" moves, in which (given that certain conditions hold to which we can respond in this sort of way) we assert sentences without depending on the previous assertion of other sentences to warrant our assertion.[2]

Dudley Shapere also contributed to the new, more theoretically committed view of observation. In Shapere 1982 he argued that what scientists mean by "direct observation" is dependent on background knowledge, and involves a rich theoretical reading of what it is that has been observed. For example, he argued that nuclear processes at the core of the sun can be "directly" observed by means of neutrinos, which proceed directly from the core to the earth, and whose flux carries information about conditions at the core.

This approach to observation in philosophy of science was a powerful force, leading many to favour some form of scientific realism in the 1960's and 70's—see, for example, Suppe 1977 (650ff). But with the publication of *The Scientific Image* (van Fraassen 1980) the tide turned. Van Fraassen proposed a new form of empiricism. He accepted the pragmatic account of observation, but found a new way to express the empiricist intuition that there is a gap between meeting the constraints

[2] Together with language entry rules, we also acquire language-language rules governing inferences, and language-exit rules linking linguistic positions to actions in the world. This simple picture of the role of language in our dealings with the world allows us both to say that our conceptual grasp of the world is inescapably shaped by our language, and to recognize the world as nevertheless constraining how we use language to grasp the world. And coping with these constraints imposes relations between different languages, which render incommensurability less than an impenetrable barrier to communication.

the evidence imposes (even when we suppose that evidence to be as complete as it could be), and being true. Van Fraassen held that by making observations using the theory's conceptual resources, we gradually constrain the set of models of the theory: the still-tenable models must satisfy these observation sentences. So observations rule out a theory altogether, if it turns out that no model can satisfy the observations made using the theory's conceptual resources. But a theory remains empirically tenable so long as our observations can all be satisfied in at least one model of the theory. A theory is empirically adequate (van Fraassen's empiricist alternative to the realist goal of truth) if all the observations that creatures like us could make in this world, using the theory's concepts, are satisfied in some model of the theory.[3]

One way to think of this is to see that it proposes a different sort of commitment to observation sentences. The argument for realism had assumed that when we make an observation claim, we commit to its truth, and so (implicitly) to the correctness of the theory whose concepts we use to express the observation. But van Fraassen offered an alternative: make observations using the conceptual resources of the theory, but don't commit to their truth; instead, regard them as suppositions, which result from making observations using a theory which may be false. If it should turn out that the resulting observations cannot all be satisfied in a single model of the theory, they can then serve in a reductio: if the theory is true, then these observations (made correctly using the theory's conceptual resources) must also be true. But there is no model of the theory in which all these observation sentences are satisfied, hence the theory cannot be true. On the other hand, the theory passes the test of observation so long as these sentences can all be satisfied in at least one model of the theory.

Further, observation, even thought of in an idealized way as including every observation that could be made in a given model of the theory, doesn't fix the value of every sentence in the theory's language: there can be theoretically distinct models which all satisfy the same maximal set of observation-reports. And different theories, which lack isomorphic models, can nevertheless be (at one and the same time) empirically adequate. So this account specifically allows for a gap between what must be true of the world if the world is a model of the theory, and what our observations, even read in this hypothetical and highly idealized way, can settle. This is van Fraassen's principal motive for not believing a theory even when he accepts it as empirically adequate: as a matter of principle, not everything it says can be tested by the observations.

[3] By "creatures like us" van Fraassen means, at least in principle, that the theory provides a description of us and our sensory capacities that sets the limits on what we can and can't observe. So in principle the limits on observation are determined in an anthropocentric way. It's worth noting that the examples van Fraassen gives of aspects of models of theories that cannot be observed don't seem to be anthropocentric in this way. Thus, for example, velocity with respect to absolute space is not just something we can't observe according to Newtonian dynamics, it's something that nothing could observe—it makes no difference whatsoever to relative motions, and similarly for the rotated quantum mechanical system he describes. Physical theories have often included such empirical danglers, but their status as danglers has generally not turned on any anthropocentric aspects of our limits as observers.

From an epistemological point of view, we have a number of options vis à vis a theory that has been empirically successful so far: first, we can choose simply to assert that the theory passes the test of observation to date. This option is pretty limited; it makes no ampliative inferences at all—Karl Popper may be the only philosopher of science of note to have espoused such a stand. Second, we can assert that the theory both has and will continue to meet the test of actual observations. This option makes as strong a commitment as to the actual course of our observations as the next two. But it has a strong air of anti-realism (in the Dummettian sense) about it—and van Fraassen has (at least so far as I can see) no inclination towards that contemporary form of verificationism. Third, we can assert that the theory would meet the test of all the observations that could be made (anytime, anywhere). This is what I take van Fraassen to mean by "empirical adequacy". Finally, we can claim in addition that it is true, or, more diffidently, approximately true.

For the purposes of this paper, we will accept the pragmatic account of observation, which leaves room both for a realistic commitment to theory, and for more reserved commitments including empirical adequacy. [4] In what follows we will consider what an account of approximate truth might be good for, discuss some difficulties a successful account must overcome, make some logical points, and then outline a fairly modest account which I think is promising.

2.3 Explaining Success

Scientific realists generally take the success of certain scientific theories to be the principle source of support for the claim that they are approximately true; in the famous "no-miracles" argument Hilary Putnam (1971)—giving credit to R. Boyd—urged that the success of science would otherwise be miraculous. Two key claims are involved here: first, that the approximate truth of a theory *explains* its success, so that the probability of success given its approximate truth is quite high. Second, that no other explanation is available, so that the probability of success given that the theory is not approximately true is very low. Given these two claims, a simple application of Bayes' theorem seems to show that the approximate truth of the theory is supported by its success:

$$P(A/S) = P(A)P(S/A) / [P(S/A)P(A) + P(S/\neg A)P(\neg A)]$$

Evidently, if $P(S/A)$ is high and $P(S/\neg A)$ is low, $P(A/S)$ will be higher than $P(A)$. But both these claims have been challenged. Some (notably van Fraassen) have offered alternative explanations of the success of science, and, as L. Laudan has argued, it's not clear how the approximate truth of a theory makes its success more

[4] A group including N. da Costa, S. French, Mikenberg, Chuaqui and O. Bueno have been pursuing a more semantically oriented version of this account of observation, according to which observations specify a partial structure which, if the theory is to meet the demands of the observations, must belong to the complete structure of at least one model of a theory. See Mikenberg *et al.* 1986, da Costa *et al.* 1990, and Bueno and De Souza 1998. Somewhat confusingly, they sometimes describe this empiricist notion of partial structures as a theory of approximate truth.

http://www.springer.com/978-1-4020-0630-2

Inconsistency in Science
Meheus, J. (Ed.)
2002, IX, 223 p., Hardcover
ISBN: 978-1-4020-0630-2