

# Constructive Empiricism and Anti-Realism<sup>1</sup>

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## 1. Introduction: Van Fraassen's constructive empiricism

Van Fraassen stresses two distinct but interrelated themes in *The Scientific Image*: the semantic view of theories and the epistemic status of unobservables. The first of these could easily be accepted by a scientific realist, and indeed realists like Giere have already adapted it to their purposes. So the specifically empiricist thread in van Fraassen's philosophy stems from the second.

Van Fraassen breaks from tradition in founding his empiricism not on the ontological status of unobservable entities but on the epistemic attitude we take to them. The main points of his position are these:

- 1) The claims of scientific theories, including claims about unobservable entities, are to be taken literally. Theories are not reconstructed so as to remove claims of the existence of unobservable objects.
- 2) Observation is a matter of direct observation by accepted participants in the human scientific community.
- 3) Accepting a scientific theory involves holding only that the theory provides an adequate model of the observable things in the world, including those things we have not yet observed but could under the right circumstances. It does not involve the belief that the theory is true throughout, but only that we cannot make observations that conflict with its edicts.
- 4) Acceptance of a scientific theory leads to its use in giving explanations and, in standard cases, commitment to a research program.
- 5) The aim of science is restricted to the provision of theories that correctly describe the observable.
- 6) We should be agnostic about the claims a theory makes that go beyond the observable.

What is the argument in favor of granting some special status to directly observable entities postulated by a theory? The crucial premise underlying van Fraassen's views is that:

The only evidence humans can obtain about whether a theory correctly describes the empirical features of the universe is what that theory says about observables.

I will call this the empiricist premise (see Churchland and Hooker 1985, pp.254-5). If the justification for accepting a scientific theory is limited to the claims that it makes about observables, then the way is open to argue that the attitudes involved in acceptance should not include the claim that it correctly describes unobservables. It is idle to pretend that a theory can claim any greater virtue or face any greater challenge than correctly describing all the observable features of the universe. Additionally, the aim of science must be limited to discovering theories that do justice to the observational evidence. For the only possible criterion of success or failure humans possess consists in a match to this evidence, and an aim cannot be something that goes beyond any possible criterion of success or failure.

## 2. The distinction between belief and agnosticism: an example

Diphtheria and Strep throat have similar symptoms in their early development. Jones, whom close readers of the philosophy of science will recall from earlier days, visits the joint practice of identical twins Anne Varfass and Sal Rite with the ambiguous symptoms of sore throat, general malaise and a temperature.<sup>2</sup> Now it is crucial that these diseases be distinguished quickly. Diphtheria is very serious and very infectious requiring isolation and immediate bed rest. It is now very unusual, but until this century it was almost invariably life-threatening. An uncomplicated case of Strep throat simply requires treatment of the symptoms of fever, bed rest, and plenty of fluids (though complications can be serious). Even antibiotics need not always be necessary, though called for in more severe cases. Both diseases are caused by a bacteria growing in the patient's throat. Jones's doctor takes a throat swab, cultures it on agar jelly in a warm place, then looks at the result through a microscope twenty-four hours later. As a result of what she sees she either gives Jones a shot and admits him to hospital or tells him to take a few days off work and take it easy.

Sal Rite believes that streptococci really exist. Anne Varfass, though she speaks professionally of bacteria of different kinds and knows no other way of saying what she wants to communicate (van Fraassen 1980, p.14), holds that she is agnostic about the existence of bacteria of all kinds. Perhaps both women agree upon a description of what they see when they look through the microscope, so long as the description is phrased in terms of oval blobs with dark shadows. Anne admits that she sees these things, and that they indicate one treatment rather than another will work, but remains agnostic about whether it is in fact bacteria she sees.

Plainly, Jones's future health doesn't depend upon which physician treats him. There is no difference in the diagnoses they make, drugs they prescribe, or tests they perform. There is no difference in their resultant behavior after a new experiment is published, nor the experiments either will perform in pursuit of a research program upon which they both agree. As long as they do not talk about philosophy, Jones might find it impossible to tell them apart.

I have stressed that van Fraassen's literal construal of scientific theories means that his dispute with the realists concerns the attitude we should take to scientific theories, rather than the content of those theories. He also holds that acceptance of a scientific theory involves commitment to a research program. I think that holding these two positions simultaneously trivializes any distinction between belief and agnosticism. This distinction is significant only when agnosticism guides behavior in a way that is different from belief, but van Fraassen's suggested agnosticism about unobservable parts of theories recommends behavior that is no different from the behavior prompted by belief in the observational parts of the theory. The recommendation to agnosticism is idle.

### 3. A condition on belief

When a scientific theory that includes unobservables is accepted and used in the practice of normal science, the unobservables play a central role in directing action. When scientists use X-ray diffraction, for example, to discover the nature of an unknown chemical, they are betting their time, energy, and reputations on the hypothesis that there is enough truth in the theory of atoms, molecules and photons not to vitiate the results. Calculations about how to build observable apparatus, or produce an observable effect concern properties of unobservable entities. Ian Hacking has done much to emphasize the use of unobservables in scientific research, which he claims must lead to belief in these entities (1983, p.263). I agree with Hacking that this kind of use entails belief, but he has not said why and how. Here I give one line of argument that spells out the connection between the two. In what follows, I shall reserve the words 'behavior' and 'action' only for non-linguistic actions, to avoid constantly saying 'non-linguistic behavior'.

One condition I think we should set upon the distinction between belief and agnosticism is:

If someone behaves in the same way with respect to two kinds of entities, then he or she cannot believe in one kind and be agnostic about the other.

This is, admittedly, a rather vague condition. However, vague as it is I think van Fraassen's distinction between agnosticism and belief in the cases of observable and unobservable entities clearly violates it. Observables and unobservables play no discernibly different role in the design of experiments or construction of apparatus. So at least the condition is not so vague as to be useless. Why should we accept this condition?

The condition in effect states that we should take the effect of belief on behavior as a better guide to what beliefs are held than the effect of belief on what is said. As the first argument in favor of this condition, consider two people who use a theory as a guide to important features of their behavior one of whom claims to believe it while the other claims agnosticism. If we take their word for it that these are indeed their mental attitudes, then the distinction is unavailable to mark off the agnostic whose agnosticism leads them to actually fail to use the theory, or hedge their bets in some way.

Secondly, suppose that mere verbal affirmation is sufficient to fix whether belief or agnosticism is involved in theory acceptance and consider how one might tell the difference between a constructive empiricist and his mirror image.<sup>3</sup> The constructive empiricist is agnostic about what a theory says about unobservables and believes in observables. The mirror image believes the theory when it comes to unobservables but is agnostic about observables. How do we tell them apart? From the things they say of course. But now how can we tell that 'I am agnostic' in mirror image language doesn't mean 'I believe' and vice versa? The meanings must fixed by the behavior connected with these words, contradicting the assumption that verbal affirmation alone fixes mental attitudes. Perhaps the constructive empiricist's meanings for 'I believe' and 'I accept' are fixed by their use in other cases and somehow carried over to the case of scientific theory acceptance. But if we are to accept action as fixing the distinction between belief and acceptance in these other cases it is hard for me to see why we should ignore it in the case of scientific theories.

A related but different argument asks how we know constructive empiricists are not just mistaken in thinking they are agnostic about unobservables. Degree of belief is after all an unobservable theoretical entity - at least as far as third parties are concerned - so the evidence for it is founded upon its impact on observables. This impact is not just limited to observable verbal behavior or consistent people could never be wrong about their degree of belief. Since they are sometimes discoverably wrong, their actions must determine the truth of their degree of belief in these cases, for the only observables available are either

actions or words. So either constructive empiricists are not discoverably wrong about the stated attitude, or we should take their actions seriously, in which case they believe with the realists.

Suppose the constructive empiricists agree that they are not discoverably wrong in their affirmations or attitudes. Then, correlatively, we cannot know that they are using the right worlds in this particular case (a tempting conclusion since these words belie their usual connection to action). Perhaps, despite their usual facility with the words 'belief' and 'agnosticism' they have been misled into using the wrong word here, for it is quite possible to do this. Since we have no evidence from their words that they are not making this kind of mistake, and strong evidence from their actions that they are, we should draw the obvious conclusion.

Van Fraassen wishes to found our attitudes toward unobservable entities on our justification for accepting them. I have argued that if one uses a theory as one has to in science then, however matters stand with respect to justification, one must believe that theory as a whole. This is because one must act no differently with respect to the unobservables as compared to observables, and by the principle above this is a sufficient condition for belief.<sup>4</sup>

So what the principle states is that deeds rather than words have a certain priority in the assessment of epistemic attitudes. What one says is not unimportant, words are quite good guides to deeds one has not had a chance to perform. I have no doubt Maxwell believed in ether, even though it did not in fact guide his behavior. He clearly would have done experiments to try to detect its drift if circumstances had been favorable. Similarly, scientists will sometimes use a theory they do not believe, because it is accurate to the tolerances of the instruments (e.g. Newtonian mechanics). We can take their word for it they would not use the theory if the instruments were more precise. We also use theories in giving us the vocabulary of scientific explanations, so theories function as guides to words as well as action, but we cannot be said to believe these explanations unless the theory is actually used practically by our community. If someone uses a particular theory in giving an explanation, we often conclude that they are part of a community of believers in that theory. So beliefs are often in practice ascribed with the help of affirmations, and of course beliefs are also used to explain utterances. But such ascriptions and explanations will be withdrawn if they conflict with behavior.

In the case of beliefs which, if true, would result in disastrous or extremely fortuitous consequences behaviors need not track the affirmations in the usual way. I would behave in the same way whether I believed there was a bomb in the room or was agnostic about it. But most cases are not of this kind. In particular, as Musgrave has pointed out, there is no greater risk of being refuted if you believe in the existence of unobservables than if you are agnostic about them (Churchland and Hooker 1985, p. 199).

I should stress that I do not think this condition is always obeyed in our ordinary talk of belief. It is rather a condition I think we ought to set upon belief. In particular, I want to emphasize that we almost invariably ascribe religious belief on the basis of verbal affirmations. Almost any behavior is held to be consonant with almost any religious claim.

#### 4. Some objections

It will be argued that we often pursue a theory that we do not accept, and accept a theory that we do not pursue, so behaviors associated with pursuit are not always correlated with the attitude of acceptance. Of course this is true, but in these cases there is always some extrinsic factor that can be cited to explain the discrepancy, for example, that pursuit of the theory would require immoral experiments. Sometimes, too, it is worthwhile to pursue a theory because it is the only one in the field, or because it would yield great

advances if it were true. In these cases extraneous factors may mean that a theory is pursued by scientists who do not believe it. But even in the absence of any such factor, when acceptance of the theory guides the practices of normal science, the behavior of the constructive empiricist is guided by all parts of the theory, not just the observables. In this case, I have argued, the constructive empiricist believes the theory.

Van Fraassen holds that when theories are accepted both the unobservables and observables are accepted and used as a guide to a research program (1980, p.12). Acceptance must include acceptance of unobservables otherwise the words "to accept a theory is (for us) to believe...that what the theory says about the observable is true" would be redundant (1980, p.18). My case might be encapsulated in the slogan that we cannot accept a theory in van Fraassen's sense without believing it.

Another objection points out that perhaps agnosticism does make a difference to behavior. For example, an agnostic about unobservable entities might be more willing to give them up in the face of evidence against the theory.

Yet the degree to which one is conservative about retaining unobservable entities by modification in the face of contrary evidence is independent of whether one is empiricist or realist. One might be a liberal realist, holding that the unobservable entities postulated by a true theory really exist while not holding that temporarily successful theories are close to the truth about unobservables. Or one might be a conservative constructive empiricist, holding that descent with modification of temporary successes is the best approach to empirically adequate theories. Although some kinds of realists do believe in approximate truth and would tend to be more conservative, this issue seems independent of the debate about constructive empiricism.

Perhaps constructive empiricists might be more willing to accept bets that their favored hypotheses will be refuted in some fixed period of time. In this case, I see no reason why the behavior of the empiricists should differ between bets about observables and unobservables. Philip Kitcher tells me that phlogiston was thought to be observable, and presumably caloric fluid was a paradigm of observable stuff. Hypotheses about observables don't seem any more secure than hypotheses about unobservables. And once again, realists might be very skeptical about the longevity of hypotheses in which they believe.

Another objection points out that, even if the behavior of the agnostic and believer is identical when it comes to the practices involved in acceptance of a scientific theory, it may differ in other areas. Perhaps the agnostic will be more inclined to apply to the philosophy department at Princeton than the believer. So the distinction between belief and agnosticism can be drawn behaviorally after all. My reply here is that just because these behaviors are outside the theoretical domain within which the entities of science exist they indicate nothing about attitudes to this domain. This can be illustrated by asking whether these extraneous behaviors are the result of the attitudes of the individual toward the entities, or the result of what the individual believes those attitudes to be. In all cases it is the latter that gives rise to the behavior. But it is precisely my point that constructive empiricists are mistaken in believing that they are agnostic about unobservable entities when this agnosticism has no effect on the way they behave when they accept a scientific theory.

I do not know if an account of differences in behavior with respect to unobservable entities can be added to constructive empiricism, but it seems to me very unlikely. Many of the observable objects of our theories are just as indirectly contacted to our senses as the unobservable objects and come to tribunals of experiments in very similar ways. This is particularly obvious for observable objects with which we will only ever have indirect contact. Perhaps no one will ever see the moons of Jupiter with the naked eye, and if

living dinosaurs are observable we have now no access to them except by routes that are extremely indirect. Observable objects, as much as unobservable ones, collapse with the theories within which they lived, and in the face of similar experiments. So I conclude that the difficulty in discovering some difference between behaviors directed towards observable and unobservable objects is a general feature of any adequate account of science.

I shall omit discussion of another objection until later. Suppose there are two theories that account for the data equally well. Scientists might use one or the other as convenience dictates, so that the behaviors associated with belief apply to both equally. But, it could be argued, the scientists cannot believe both, because the theories could be contradictory, and perhaps the scientists know this.

## 5 Whither empiricism?

What comfort can scientific realists take from the foregoing? Very little I think. In the first place, I have granted van Fraassen the hypothesis, so brilliantly defended in *The Scientific Image*, that the sole test of acceptability for a scientific theory is whether or not it copes with the directly observable phenomena. Secondly, my argument against van Fraassen is from an unreservedly anti-realist standpoint. I have claimed that van Fraassen's view does not give enough weight to the conditions under which beliefs are ascribed. If one is a realist about belief, one might claim that one can have or lack beliefs independently of the possibility of a third party being able to decide the matter through observable behavior. Such a view, I argued, is idle when it comes to explaining the things we want our theory of beliefs to explain.

In this section I want to do no more than give the barest outlines of an alternative to van Fraassen's empiricism that is not subject to the criticisms I've made here.

Since we cannot remain agnostic about things that are not directly observable how are we to do justice to the empiricist premise? The premise was that the sole criterion of the correctness of a scientific theory lies in its connections to the directly observable. Our acceptance of a scientific theory should not therefore exceed this criterion. But we can respect this condition by using the resources of semantic anti-realism.

The characteristic thesis of semantic anti-realism is that:

The truth conditions of a sentence are exhausted by our abilities to recognize it as true or false.

Combining this with the empiricist premise we get:

The truth conditions of the sentences of scientific theories (or the conditions upon acceptable classes of models) are exhausted by their connections to directly observable phenomena.

There is no claim that we should not believe the theories we pursue. There is a claim that the only truth that such belief involves is that to which we can have epistemic access. If the big bang erased the possibility of knowledge of events prior to it, then sentences tensed before that event have no truth value. Empiricism is restored to an ontological claim, but the ontological realm is limited by the epistemological.

If this approach is taken, then the problem I cited earlier concerning the underdetermination of theory by data can be solved. For by the reasoning above, two empirically equivalent theories have the same truth conditions. Hence there is no contradiction in believing them both. Because the meaning of the sentences of the theory is their truth conditions, the apparent contradictoriness of sentences in different empirically

equivalent theories must be the result of different meanings for similar sounding words. If one holds the semantic view of scientific theories, the different models must also be models of the same phenomena and cannot be in conflict with each other. This line of thought is familiar from the work of Sklar (1974), who has also done much to highlight its difficulties (1980). It is also to be found in Dummett (1978), Putnam (1981, 1983) and others.

This approach is largely unarticulated at present. Is it to be an empiricism founded upon experiments we actually perform, or those we can possibly perform, and if so, then in what sense of 'possibly'? In what way are the connections between the theory and observation to be spelled out? The view is free of two problems that have beset similar past approaches, however. It does not have to claim that unverifiable statements are meaningless. If a statement is unverifiable, then it has no truth value, but it could still have knowable truth conditions, and hence be meaningful. We know its truth condition by knowing the meanings of the words composing it and how they determine truth conditions. Neither is this approach wedded to an epistemology of sense data.

Though it would be foolish to minimize the problems surrounding this view, I think it is the best hope for an empiricism that takes account of the insights van Fraassen has so ably defended. There is something wrong with metaphysics not when it is involved with the unobservable, but when it is empirically idle.

### Notes

<sup>1</sup>I'm grateful to Stephen Stich, Lisa Lloyd, Philip Kitcher, Mike Bishop, Warren Dow, and Mike Dietrich for their help with this paper.

<sup>2</sup>The medical details of this example are inaccurate. Please just pretend the facts are as I state them.

<sup>3</sup>This argument is a development of one Stephen Stich kindly suggested.

<sup>4</sup>In the jargon of the philosophy of mind, I am claiming that degree of belief is supervenient on non-linguistic action, widely described, including acts in counterfactual situations.

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