What can Bas believe? Musgrave and van Fraassen on observability

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There is a natural objection to the epistemic coherence of Bas van Fraassen's use of a distinction between the observable and unobservable in his constructive empiricism, an objection that has been raised with particular clarity by Alan Musgrave. We outline Musgrave's objection, and then consider how one might interpret and evaluate van Fraassen's response.

According to the constructive empiricist, observability for us is measured with respect to the epistemic limits of human beings *qua* measuring devices, limitations 'which will be described in detail in the final physics and biology' (van Fraassen 1980: 17). In order for the constructive empiricist to determine what counts as observable, he will have to appeal to our best scientific theories of light, human physiology, and so forth. To put the same point in a slightly more abstract way, in order to draw a distinction between observable and unobservable entities, the constructive empiricist needs to use his best scientific theory of observability – call it T* – to tell him the identity of the observable entities.

This raises an interesting difficulty. Constructive empiricism is the view that 'science aims to give us theories that are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate' (van Fraassen 1980:12). When he accepts a theory, the constructive empiricist only believes the statements of his scientific theories that are about observable entities. Thus, in order to know which statements of a scientific theory to believe, the constructive empiricist needs to know which statements of that theory are about observable entities. In particular then, the constructive empiricist only believes the statements of his theory of observability T* that are about observable entities. Therefore, in order to know which statements of T* he can believe, the constructive empiricist needs to know which statements of T* are about observable entities. However, it is T* that tells the constructive empiricist what counts as an observable entity: the constructive empiricist therefore needs to use T* to tell him which statements of T* he can believe.

The fact that the distinction drawn by T* must also apply to itself is not an immediate cause for alarm. We ask the constructive empiricist which parts of his theory of observability he can believe, and he responds with a rigorous criterion; it just so happens that this criterion is supplied by the theory of observability in question. There is a sense then in which the

constructive empiricist's distinction between observable and unobservable entities is circular, but not all circles are vicious. Some circles are benign and some even support their application. To take a familiar example, Karl Popper's distinction between science and non-science was based on the criterion of falsifiability, a criterion which also applies to itself. Yet Popper's distinction, whatever else one may think of it, remains perfectly intelligible: even though his distinction between science and non-science rendered the criterion itself non-scientific, it did not render itself incoherent.

Unfortunately, it is far from clear that the constructive empiricist's position is similarly inoculated. The basic problem facing the constructive empiricist is that he has no guarantee that the parts of his theory of observability that he *needs* to believe will coincide with the parts of his theory of observability that he *can* believe. The constructive empiricist only believes the statements of his theories that are about observable entities; thus he only believes the statements of his theory of observability that are about observable entities. A conflict then appears to arise if the crucial statements of the constructive empiricist's theory of observability – the ones that tell him what counts as an observable entity – are not themselves statements about observable entities. If the statements of the theory of observability that tell the constructive empiricist which statements he can believe are not themselves statements he can believe, he is in trouble.

This is the concern raised by Musgrave (1985: 207-209), who argues that *in fact* some of the statements the constructive empiricist needs to believe are not statements that he can believe. For some of the statements the constructive empiricist needs to believe in order to draw a distinction between observable and unobservable entities will be of the form 'x is unobservable', which is clearly *not* a statement about an observable entity, and thus presumably not the sort of statement the constructive empiricist can believe. The constructive empiricist's distinction between observable and unobservable entities is therefore not so much Popperian as Positivist: just as the verification principle specified a criterion for *meaningfulness* that it itself apparently fails to meet, so the constructive empiricist's observable/unobservable distinction specifies a criterion for *belief* that it itself fails to meet. Consequently, since the distinction between observable and unobservable entities is fundamental to constructive empiricism, and since this is a distinction the specification of which the constructive empiricist himself cannot believe, Musgrave concludes that the position is untenable.

One response available to the constructive empiricist is to question whether he really does need to *believe* statements of the form 'x is unobservable'. It may be that the weaker

epistemic attitude of *acceptance* towards these statements is sufficient for subsequently using these statements to draw a rigorous distinction between observable and unobservable entities. This however is not van Fraassen's approach; nor is it a strategy we will pursue further here. But we would like briefly to consider another natural response that van Fraassen does not give. Musgrave only objects to the constructive empiricist believing statements of the form 'x is unobservable'. Statements of the form 'x is observable', since they are presumably statements about observable entities, appear by contrast to be just the sort of statements the constructive empiricist *can* believe. So perhaps Musgrave's objection is toothless. For if the constructive empiricist can believe the statements of his theory of observability of the form 'x is observable', then it looks as if he can draw his distinction between observable and unobservable entities after all, from the observable side.

This response has some merit, but it does not give the constructive empiricist everything he might wish. For one thing, we may wonder whether a constructive empiricist is entitled to believe even statements of the form 'x is observable', since although if such a statement is true then the x is of course observable, still one may object that the property of observability is not itself observable. But leave this to one side for the moment. Believing all the consequences of T* of the form 'x is observable' may entitle the constructive empiricist to believe some of consequences of a theory he accepts – those his theory of observability certifies as being about observable entities. Since he has no guarantee that T* is complete however, it does not tell him of the remaining consequences whether he should believe them or not. Perhaps such a consequence is about unobservable entities and so should not be believed, or perhaps it is about observed entities that his theory of observability does not consider or mistakenly counts as unobservable.

To this objection from incompleteness the constructive empiricist might with some justice reply that agnosticism about agnosticism is also a form of agnosticism. If the consequence of T is about an entity that T* does not certify to be observable, then whether that entity is unobservable or observable but just not certified as such, the constructive empiricist will just have to be agnostic about the truth-value of the statement. If he cannot believe statements of the form 'x is unobservable', the constructive empiricist will not be in a position to specify the boundary between the observable and the unobservable, but there are still some statements he can believe, and others over which he will be agnostic.

Van Fraassen, however, takes a different line, because he thinks that, if the constructive empiricist accepts T*, he is entitled to believe its consequences of the form 'x is unobservable'. His response is worth quoting in full:

Musgrave says that '[x] is not observable by humans' is not a statement about what is observable by humans. Hence, if a theory entails it, and I believe the theory to be empirically adequate, it does not follow that I believe that [x] is not observable. The problem may only lie in the way I sometimes give rough and intuitive rephrasings of the concept of empirical adequacy. Suppose T entails that statement. Then T has no model in which [x] occurs among the empirical substructures. Hence, if [x] is real and observable, not all observable phenomena fit into a model of T in the right way, and then T is not empirically adequate. So, if I believe T to be empirically adequate, then I also believe that [x] is unobservable if it is real. I think that is enough. (1985: 256)

Enough for van Fraassen perhaps; but Musgrave has admitted to not understanding this response (cf. Muller 2004: 81), and one suspects that he not alone.

Let us try then to illuminate what we take to be van Fraassen's argument. Suppose that our theory T* entails that 'x is unobservable'. Further, suppose that x is in fact observable. It follows then that T* says something false about x, namely that it is unobservable when in fact it is observable. But more importantly, if T* says something false about x, and if x is observable, *then T* says something false about an observable entity*. However, if we as constructive empiricists believe T* to be empirically adequate, then we believe that what T* says about observable entities is true. Consequently, if T* entails that 'x is unobservable', and if we believe that T* is empirically adequate, then we must also believe that 'x is unobservable' is true: for if 'x is unobservable' was false, T* would say something false about an observable entity, contradicting our belief that T* was empirically adequate.

We can perhaps make the same point another way. If the constructive empiricist believes a theory T to be empirically adequate, then he can only be agnostic about a consequence of T if the empirical adequacy of T does not depend upon the truth-value of that statement. Generally, this means that if the constructive empiricist believes his theory T to be empirically adequate, he can be agnostic about any consequence about unobservables, but he must believe any consequence about observables. It is perfectly legitimate for the constructive empiricist to be agnostic about a consequence of T such as 'electrons have negative charge', for even if this statement is false, this does not undermine the empirical adequacy of the theory, since a theory is empirically adequate if what it says about observable entities is true and electrons are not observable. By contrast, the constructive empiricist cannot be agnostic about a consequence of a theory he accepts such as 'the table has four legs'; for if this statement were false then his

theory would say something false about an observable, and would therefore fail to be empirically adequate. What is surprising, however, is that statements of the form 'x is unobservable', despite being statements about unobservable entities, actually function more like statements about observable entities in this respect: if 'x is unobservable' is false, then the theory that entails it says something false about an observable entity, and so is not empirically adequate. Therefore, to believe a theory is empirically adequate commits one to believing that 'x is unobservable' is true, if that statement is a consequence of the theory.

This then is the gist of van Fraassen's response, but there is one further complication to be introduced. The falsity of 'x is unobservable' as it stands does not necessarily entail the empirical inadequacy of a theory that entails it. This is because there are *two* ways such a statement can be false: either because x is observable, as discussed above; or because x does not exist. The problem then is that if 'x is unobservable' is false for the latter reason – because there is no x – then the empirical adequacy of the theory is not threatened. A theory is empirically adequate provided what it says about the observable entities is true; and although this is inconsistent with making a false claim about an observable entity, claims about a non-existing entity are simply irrelevant to this evaluation.

This difficulty however is easily resolved. As van Fraassen notes, to believe that T* is empirically adequate is to believe that x is unobservable *if it is real*. The consequences of the constructive empiricist's theory of observability are thus to be understood as conditional statements: rather than 'x is unobservable', we are to take them as stating '*if x exists*, then it is unobservable'. That this minor complication resolves the above difficulty is easy to see. The only way such a conditional can be false is if x exists, but is not observable; thus if such a conditional is false, it says something false about an existing, observable entity. The same argument can then go through as before: since a theory is empirically adequate provided it gets it right about the observable entities, it is inconsistent for such a theory to make a false claim about an existing, observable entity[1]. The ambiguity over how a statement such as 'x is unobservable' could be false is thus avoided. In what follows we shall take all statements of the form 'x is unobservable' to be understood in this conditional form; although for the sake of clarity of the rest of the argument, this complication will often be suppressed.

Thus, the constructive empiricist can believe (and indeed, if he believes the theory to be empirically adequate, must believe) statements of the form 'x is unobservable', since they are deductively entailed by his belief that T is empirically adequate. This seems to resolve Musgrave's objection. Although statements of the form 'x is unobservable' are statements

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[1] We would like to thank Mary Leng for clarifying this point for us.

about unobservable entities (and thus prima facie statements the constructive empiricist cannot believe), they also constitute a special case. They are deductively entailed by the claim that the theory is empirically adequate, which the constructive empiricist believes; and since the constructive empiricist can believe any statement that is logically entailed by a statement he believes, the constructive empiricist can in fact believe these statements.

That is our attempt to explain van Fraassen's subtle response to Musgrave, subtle because it hinges on a peculiarity of statements of consequences of T* of the form 'x is unobservable': their truth is entailed by the claim that T* is empirically adequate, even though they are not about observables. We turn now, however, to an objection to this reply to Musgrave, and then to an alternative reply that van Fraassen could give, based on what he says elsewhere.

The objection hinges on a different way of understanding observability, such that even if 'x is unobservable' is false, T* may be empirically adequate. Suppose that for a claim to be about what is observable, what counts is not the observability of the entity, but rather the observability of the *phenomenon*, or if you like the property attributed to the entity. In this case, since the property of being unobservable is presumably not observable, the constructive empiricist's belief that 'T* is empirically adequate' does not commit him to the belief in the consequence that 'x is unobservable', and so van Fraassen's response to Musgrave, as we have construed it, won't succeed. For even if the statement that x is unobservable were false, it would not be making a false claim about an observable property.

Elsewhere, however, van Fraassen says something a bit different about empirical adequacy that suggests a different response to Musgrave. It is to take the claim that a theory is empirical adequate already to involve a belief specifying the demarcation between the observable and the unobservable. As he puts it:

> To present a theory is to specify a family of structures, its 'models'; and secondly, *to specify parts of those models (the 'empirical substructures') as candidates for the direct representation of observable phenomena*. The structures which can be described in experimental and measurement reports we can call 'appearances': the theory is empirically adequate if it has some model such that that all appearances are isomorphic to empirical substructures of that model. (1980: 64, emphasis added)

The idea then is that although 'x is unobservable', whether true or false, does not attribute an observable property to an observable entity, it is a statement that helps to specify what does and does not count as the empirical substructure of a model. Hence, since a theory is

empirically adequate iff the statements it entails about observable phenomena are true, and that the statements have been correctly classified (we have presented 'parts of those models … as candidates for the direct representation of observable phenomena'), the falsity of 'x is unobservable' does entail the empirical inadequacy of a theory. The theory would be empirically inadequate because it presentation would involve a misidentification of the empirical substructures.

Specifying empirical adequacy in this way therefore ensures the privileged status of 'x is unobservable', even if a predication of unobservability precludes a statement from itself figuring in the empirical substructure. On this view, the constructive empiricist is committed to that statement not because it might be about observables, but because commitment to its truth is nevertheless a part of the commitment to the empirical adequacy of the theory that entails it.

It is not however clear that this is an adequate reply to Musgrave. His objection was that the constructive empiricist is not entitled to believe his distinction between observable and unobservable phenomena. The present response simply asserts that if the constructive empiricist accepts a theory, then he *must* draw such a distinction, since this is part of what acceptance involves. Consequently, it seems that such a response fails to engage with Musgrave's objection. Moreover, it seems that even what we have taken to be van Fraassen's official response to Musgrave may beg the question, though somewhat less blatantly. For if a belief in empirical adequacy commits one to a belief in the truth of statements of the form 'x is unobservable', then those who think like Musgrave might well complain that what this shows is not that the constructive empiricist is entitled to believe such statements, but rather that belief in empirical adequacy already transcends the strictures on belief that the constructive empiricist is attempting to respect.

Van Fraassen suggests that we determine the demarcation between the observable and the unobservable, and hence the dividing line between what we believe and what we do not believe, by appeal to an empirical theory of observability. Musgrave objects that this will not work, because the constructive empiricist is not entitled to believe what that theory says, when it claims that an entity is unobservable. We have considered various replies to this objection. One is that the constructive empiricist make do with what his theory says is observable; but this will not provide a full demarcation. Another is that the constructive empiricist is entitled to believe a theory's claim that an entity is unobservable, since if that claim were false, the theory would not be empirically adequate. But that may not be right, since to say of an observable entity that it is unobservable is not to make a claim about an observable property.

A third reply is that to believe that a theory is empirically adequate is *ipso facto* to believe that a specified demarcation holds; but this may beg Musgrave's question[2].

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References

Musgrave, A. 1985. Constructive empiricism and realism. In *Images of Science: Essays on Realism and Empiricism, with a Reply from B. C. van Fraassen*, eds. P. M. Churchland and C. A. Hooker, 196-208. Chicago: University of Chicago Press.

Muller, F. A. 2004. Can a constructive empiricist adopt the concept of observability? *Philosophy of Science* 71: 80-97.

van Fraassen, B. C. 1980. *The Scientific Image*. Oxford: Clarendon Press.

van Fraassen, B. C. 1985. Empiricism in the philosophy of science. In *Images of Science: Essays on Realism and Empiricism, with a Reply from B. C. van Fraassen*, eds. P. M. Churchland and C. A. Hooker, 245-308. Chicago: University of Chicago Press.