Deconstructing van Fraassen's observable/unobservable dichotomy

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Abstract

Van Fraassen bases his alternative to scientific realism, constructive empiricism, on a dichotomy between the observable and the unobservable. This paper argues that the implications of the dichotomy regarding microscopy can not be made to stand, and that the dichotomy might even be unnecessary to set forward the epistemic attitudes of constructive empiricism.

1 Introduction

Since the breakdown of the theoretical terms/observational terms dichotomy (theory/observation dichotomy), (entity) realists made their case for the possibility of observing what under logical positivism were seen as theoretical terms. For example, Grover Maxwell (1962) considers that due to the impossibility of making a clear theory/observation distinction (since according to Maxwell there is a continuous transition from observable to unobservable) we cannot consider 'electron' to be a theoretical term. Regarding the theory/observation distinction van Fraassen considers that we can separate the discussion in two issues: "Can we divide our language into a theoretical and non-theoretical part? On the other hand, can we classify objects and events into observable and unobservable ones? " (van Fraassen 1980, 14).

Van Fraassen accepts the consolidated view that the answer to the first question is negative, but by disentangling from it the second question he can give a positive answer to this question enabling him to promote a new dichotomy that, like the previous one before, can be used, for example, as a barrier to the scientific realist belief in the existence of electrons. With his new dichotomy van Fraassen has the instrument to promote an anti-realist position. Theories only need to save observable regularities, in this case they have empirical adequacy. This does not imply that the scientific image we are immersed in when accepting a theory has ontological significance regarding the unobservable aspects of the world; we can be agnostic, since the "immersion in the theoretical world-picture does not preclude 'bracketing' its ontological implications" (van Fraassen 1980, 81); also to van Fraassen this dichotomy has implications regarding our epistemic attitudes: it suggests that our knowledge is limited: "the amount of belief involved in [a theory] acceptance is typically less according to anti-realism" (van Fraassen 1980, 13).

2 Letting go of the observable/unobservable dichotomy

Van Fraassen rejects Maxwell's argument, because Maxwell does not justifies the supposed "continuous series beginning with looking through a vacuum and containing these as members: looking though a windowpane, looking though glasses, looking through binoculars, looking through a low-power microscope, looking through a high-power microscope, etc." (Maxwell 2009 [1962], 453). Van Fraassen considers that even if observable is a vague predicate due to the fact that it is not possible to draw the line between the observable and the unobservable clearly, this does not imply that the dichotomy is meaningless. According to him the dichotomy is tenable if we can present clear examples of observable and unobservable things, events, etc. To van Fraassen the moons of Jupiter are observable, not because we can see them using a telescope, but because an astronaut could see them directly. It is this seeing with the naked eye (or other non-aided modes of perception) that van Fraassen calls observation. To him an electron (if existing) is not observable.

An important contra-argumentation was made by Ian Hacking, which put forward, in particular, the so-called argument of the grid. In it, a barely visible disc of metal is supposed to be engraved with an unobservable square grid with a letter in each square. According to Hacking, "we look at the tiny disc through almost any kind of microscope and see exactly the same shapes and letters as were originally drawn on a large scale" (Hacking 1983, 203); and why is that? According to Hacking, "I know what I see through the microscope is veridical because we *made* the grid to be just that way. I know that the process of manufacture is reliable, because we can check the results with the microscope" (Hacking 1983, 203). Van Fraassen dismisses Hacking's argument due to its circularity (van Fraassen 1985, 297-8).

What is missing in Hacking's account of microscopy is the key operational procedure called calibration. Loosely speaking, to calibrate an instrument is to follow an operational procedure that makes the instrument work in a similar way to another for a particular range. One example of calibration is that of different thermometers, so that they give the same temperature reading in a overlapping temperature range (Chang 2004). The same goes with microscopes. In this case *the microscopic grid (that we see with a light microscope) is used for the calibration of the electron microscope*. As William Seager called the attention to, the microscopic grid is used first of all

> for the detection and correction of aberrations in the [electron] microscope. That is, the electron lens of a microscope is adjusted to give the perfect grid appearance, and once the image looks sufficiently rectilinear, the microscope ... is pronounced fit for service. The grid is then used to calibrate the microscope so that accurate size measurements of new images are possible. (Seager 1995, 466)

In simple terms, if we are confident on the workings of the light microscope we can calibrate the electron microscope to it. And how can we be confident on the light microscope? Because we calibrate the optical microscope to our vision. In this way, Maxwell's intuition of a continuous series was in part right: w*hen considering a series of calibration procedures, it is possible to give a meaningful notion of a 'continuous series' that goes from naked eye perception to aided perception with a series of instruments*. *It is the calibration that creates the 'continuous series'*.

Contrary to van Fraassen's view it is relevant that it is not possible to draw the line between the observable and the unobservable clearly. It is true that while we can see the hind end of an ant there is a point beyond which we cannot distinguish details of the structure without the optical microscope. But, *there is a range in which we can check what we see with the optical microscope with what we see with the naked eye*. Van Fraassen does not provide an argument that shows there to be a relevant difference between the smaller structural feature a member of the epistemic community can distinguish and a more detailed view of these structural features only seen with the optical microscope. *Since there is no convincing argument to the contrary, I consider that when calibrating the optical microscope to our vision we extend our visual range into a domain beyond normal human capacity* (i.e. into what van Fraassen includes in the category of unobservable).

This result does not have to imply that van Fraassen's dichotomy is in danger. One only needs to take the diffuse line between observable and unobservable to be beyond the last link (instrument) in the calibration series. Regarding van Fraassen's views of 'electrons' as unobservable-to-us, it seems that even granting that one sees with the help of an electron microscope, one does not sees 'electrons'. The most one could say, following entity realists, is that for example one is detecting electrons using a cloud chamber; after all we do not see with a cloud chamber (van Fraassen 1980, 17).

One could ask: why did van Fraassen come up with the idea that one does not see with the help of a microscope in the first place, since one cannot expect to use microscopes to see, e.g., electrons? I think the answer is in Maxwell's original argument of the continuum, in which Maxwell does not make any distinction between seeing and detecting, giving the impression that there is a 'continuous series' that goes all the way from seeing apples to the detection of electrons. This confusion was made possible due to the fact that *neither Maxwell nor van Fraassen took into account the calibration of scientific instruments, which gives us criteria to distinguish between instrumental aids to our vision (for example microscopes, which are calibrated between them) and different classes of instruments (like thermometers, which are calibrated between them)*.

It would seem that when accepting that we see with microscopes one only has to rephrase van Fraassen's views, by making a fine-tuning in the words we use to define the dichotomy. Instead of just using the terms 'observable' and 'unobservable', one should give more details, making explicit the difference between 'observable (even if with the aid of microscopes)' and 'detectable (i.e. not observable with the aid of microscopes, but 'indirectly' detectable using complex instrumentation)'. We could even leave out the word 'unobservable', and talk about things, processes, and so on, that are observable or only detectable.

In setting forward his dichotomy, van Fraassen is playing the game of realists and accepts that putative entities postulated in *some* realist readings of physical theories can be classified as unobservable-to-us (following the realist's own prescription according to which the electrons can only be detected and not observed); then, from this perspective he argues for epistemic limitations to the realist's claims by using the metaphysical categories of the realist (i.e. observable and unobservable). However one might ask: is it really necessary to use, even if agnostically, the realists' metaphysics to promote a particular anti-realist epistemic attitude; i.e. is it not possible within constructive empiricism to promote the attitude without implicit resort to this metaphysics?

I think one can promote basically the epistemic attitude being proposed by van Fraassen when starting from a criticism of entity realism, without having to resort to the dichotomy emerging from realism. This can be achieved by considering van Fraassen's own views on experimentation and physical theories. In *The Scientific Image*, van Fraassen presents what to some entity realists is an experiment to measure the electric charge of the electron as “filling in a value for a quantity which, in the construction of the theory, was so far left open” (van Fraassen 1980, 77). To van Fraassen, *Millikan's experiment does not consist in measuring/detecting a property of a putative unobservable entity*; on the contrary, to him we assist to “the continuation of theory construction by other means” (van Fraassen 1980, 77). For the case being made here the important point is that van Fraassen can give an account of the experiments without any need to accept a realist view dependent on a putative unobservable: *if we do not need 'detectable' in our account of physical experimentation, we also do not need the putative unobservable that we detect, i.e. if we are doing something different from detecting some unobservable-to-us, we do not need to take stock in the idea of unobservable.*

Thus, by following van Fraassen's own account of experimentation we find it difficult to justify a particular epistemic attitude developed in terms of the observable/unobservable dichotomy, since without the idea of 'detection' we lose one side of the dichotomy, the 'unobservable'.

With this view on experimentation we have an argument, that does not play the game of realist metaphysics, to promote a similar epistemic attitude to the one being proposed by van Fraassen on account of the dichotomy: *there is no detection, and so there is nothing (unobservable) being detected; there is only the (observed-)phenomena; a theory is accepted if it has empirical adequacy, i.e. if it saves the (observed-)phenomena*. Thus, by following van Fraassen's views on experimentation we have the means to establish epistemic limitations to what the entity realist proposes without any need for the observable/unobservable dichotomy.

References

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