Philsoc Student Essay Prize, Michaelmas term, 2020 – 2nd Equal Prize

Critically assess constructive empiricism

By Paul Dixon

Introduction

Bas van Fraassen's constructive empiricism provides anti-realists with a strong alternative account to challenge the views of scientific realists, especially concerning the interpretation of unobservables in scientific theory. Realists have responded with several important criticisms of constructive empiricism. In this short paper I find that constructive empiricism, whilst offering appealing modesty regarding what constitutes scientific knowledge, incorporates a vagueness that scientists often seek to avoid.

Constructive Empiricism ('CE')

Van Fraassen's CE takes an alternative stance to traditional anti-realism in its challenge to the pre-eminence of scientific realism. CE proceeds by accepting the metaphysical and semantic components of scientific realism but denies the epistemic component. Regarding metaphysical claims, constructive empiricists accept there exists a mind-independent world, unlike historical anti-realists such as Berkeley's idealists. Considering semantic claims, scientific realism takes theoretical statements at 'face value'; facts are literally true or false. Constructive empiricists generally accept this claim. By way of contrast, anti-realists, such as the logical empiricists or 'instrumentalists' deny this; they hold that claims about unobservable things literally have no meaning (Chakravartty, 2017).

Regarding epistemological claims, scientific realists believe that science aims at truth with respect to unobservables. Constructive empiricists accept truth statements about observables, but importantly deny truth statements about unobservables. Specifically, CE takes the view that science aims to give us theories which are empirically adequate, and that acceptance of a scientific theory involves the belief only that it is empirically adequate. According to van Fraassen, scientific realists hold that science aims to give us, in its theories, a literally true story of what the world is like; that acceptance of a scientific theory involves the belief that it is true (1980).

Below I consider some key aspects of constructive empiricism.

1. Attitude to Observables

Constructive empiricists hold that a theory is true if it saves, that is, predicts or explains, all of the actual past, present and future observable, not just the observed phenomena. A tree falling in the woods is observable, even if unobserved. CE makes no claim as to the truth of statements about unobservables. Constructive empiricists accept our theories can be committed to the existence of unobservables (such as electrons, neutrinos etc), but that does not entail that scientists must believe in the literal truth of their existence. Van Fraassen does not argue against rationality in believing in unobservables, but against reasonability: CE is epistemically modest and cautious. Van Fraassen sees no empirical gain in inferring more than the empirical adequacy of a theory.

2. Empirical Adequacy

By holding theories to the standard of empirical adequacy, CE holds that scientists may accept and use theories, rather than take them to be literally true. Constructive empiricists also deny that science chooses its preferred theories based on 'super-empirical virtues' for epistemic reasons; that is, a wider set of scientific principles that support a narrower theory. Rather, van Fraassen sees such choices as made for pragmatic reasons.

3. Inference to Best Explanation, and Explanation

Scientific realists often hold up the plausibility of Inference to Best Explanation ('IBE') as our best method for gaining knowledge, as supportive of realism. However, van Fraassen argues that CE can equally explain IBE's success in instrumental, pragmatic terms, rather than the more ambitious truth claims of scientific realism. Realist commitments to explanation in science arise from a desire that

knowledge as justified true belief must incorporate coherent explanations. However, van Fraassen notes that explanations depend on context; and some phenomena (e.g., Big Bang) have no readily accessible explanation. Van Fraassen's CE demands less of explanations, offering philosophers of science a more pragmatic approach.

In favour of Constructive Empiricism

Constructive Empiricism, in its satisfaction with empirical adequacy, makes more modest claims than scientific realism. In so doing, it takes relatively less epistemic risk. For example, CE can accept two theories that display equal empirical evidence without a commitment to believe in one or both as true. This is a contradiction that would be unsatisfactory for scientific realists, who would seek a crucial experiment or more confirmatory evidence.

Constructive empiricists' modest claims about unobservables appears at first as a significant strength. Over time, because science has refuted many prior theories that posited unobservables, such as the phlogiston theory of combustion or the luminous ether theory of light, modesty seems advisable. Furthermore, the pessimistic meta-induction theory of past falsity ('PMI') suggests we should remain modest about those aspects we hold to be 'true' in our best theories today, especially with respect to unobservables. PMI claims that, since most of our best theories in the past have since been falsified, and current theories are similar in kind to our past theories, it is likely that today's theories are also false.

Finally, constructive empiricists offer an alternative account of the role of explanations in science, whereby explanations are highly context-dependent. These explanations are pragmatic and depend on the particular 'questions asked' by both scientists and non-scientists. Such explanations do not consist of a formal core, as argued by some, but are more plastic. This addition of the pragmatic component is seen as more accurate by constructive empiricists than previous definitions of explanation (Isaacs, 2020).

Problems for Constructive Empiricism

Some, including Maxwell (1998) have noted significant problems for CE when we scrutinise the concept of observables. First, the boundary between observable and unobservable appears vague. Consider the following: i) an ant observed by human eye, a magnifying glass, or a microscope. ii) A planet observed by the 'naked' eye, or a telescope. iii) A virus observed using an electron microscope. iv) Dinosaurs 'could have been' observed 65 million years ago. v) A moon of Jupiter 'could be' observed closely by an observer on a nearby spacecraft. In each of these cases, there is a vagueness around what constitutes observability dependent on whether we propose a link to 'unaided' observability; an observability based on inference, e.g., that electron microscope images represent something real; or in the last two cases, hypothetical observability.

Van Fraassen defends his view by admitting observables as a "vague predicate" (van Fraassen, 1998). He goes on to claim that use of a telescope to see the moons of Jupiter is a clear case of observation, whereas the ionization of particles in a cloud chamber is not. He defends this further by claiming that the ionized particle is 'detected', whereas the moons are 'seen'. He accepts hypothetical observation as valid. Van Fraassen grounds his definition of the observable boundary in the fact that the human organism is a kind of "measuring apparatus"; and he dismisses criticisms as semantic trickery. But Maxwell and others probe pertinent questions along the following lines: if spectacles are acceptable visual correction, why not an optical telescope, or a microscope? Is a very distant planet not also merely 'detected'?

Second, even if one were to grant constructive empiricism's definition of the observable boundary, others (e.g., Godfrey-Smith) have argued that we can legitimately shift this boundary from the observable to the detectable. Godfrey-Smith argues that the aims of science can and should justifiably incorporate a receding horizon of confidence: as we move from observation, to detection,

to inference from other data. Furthermore, for Godfrey-Smith, simple empirical adequacy should be an aim of science, but need not be the only aim (Godfrey-Smith, 2003).

Third, a problem has been posed against van Fraassen's satisfaction with empirical adequacy. Some, for example Musgrave, have argued that constructive empiricism's distinction between truth and empirical adequacy is less than it appears: for example he cites the underdetermination problem to constructive empiricism's empirically adequate theories as equally troublesome as it is for theories based on unobservables (Curd & Cover, 1998, p. 1241). Constructive empiricists respond that the risks to their anti-realist position are lower. van Fraassen noted "it is not an epistemological principle that one might as well hang for a sheep as a lamb" (1980, p. 72). In this respect van Fraassen presents a reasonable argument: for example, it would have been a greater misstep to have claimed that Newton's laws of gravitation were always and everywhere true, than to have claimed they were empirically adequate - which they were for the purpose and scope of 17th century science.

Finally, whilst PMI can be used to support the constructive empiricist stance towards unobservables, Churchland notes that "witches, and the starry sphere which turns about us" were both observable yet subsequently shown to be thoroughly false (1985). Hence, observation does not automatically equate to success. Constructive empiricists, however, defend their position by highlighting that they do not claim immunity from fallibility; just that they 'risk less' on theories of knowledge based on observables, as claimed above in the defence of empirical adequacy.

Conclusion

Constructive empiricism is a modest, pragmatic interpretation of anti-realism accommodating many positive realist attributes, whilst avoiding some sceptical and underdetermination problems for realists. Its reinterpretation of the role of explanation in science is a particular strength. Yet some of its assumptions, especially those concerning the observable-unobservable distinction, remain an Achilles' heel. These must be developed further to make it a truly compelling alternative theory to scientific realism.

Bibliography

Chakravartty, Anjan. (2017, Summer). Scientific Realism. Retrieved from Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/cgi-bin/encyclopedia/archinfo.cgi?entry=scientific-realism

Churchland, Paul. (1985). Images of Science. Chicago: Chicago University Press.

Curd, M., & Cover, J. (1998). Philosophy of Science: The Central Issues. NY: Norton.

Godfrey-Smith, P. (2003). Theory and Reality. Chicago: Chicago University Press.

Isaacs, I. (2020, November 18). Constructive Empiricism. Philosophy of Science: Summary Unit 8. Oxford: Oxford University.

Maxwell, G. (1998). The Ontological Status of Theoretical Entities. In M. Curd, & J. Cover, Philosophy of Science: The Central Issues (pp. 1052-1063). NY: Norton.

van Fraassen, B. (1980). The Scientific Image. Oxford: OUP.

van Fraassen, B. (1998). Arguments Concerning Scientific Realism. In M. Curd, & J. Cover, Philosophy of Science: The Central Issues (pp. 1064-1087). NY: Norton.