Are the core commitments of scientific realism defensible?

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In this essay, I argue that the core commitments of scientific realism are defensible. I begin with an account of what scientific realism is. I then argue that the modest form of scientific realism is either the same position as the strong form or not scientific realism at all. Having clarified this, I specify the commitments a scientific realist makes and defend these commitments against the most prominent critiques and objections to scientific realism.

Scientific realism is characterized differently by various writers, rendering the formulation of a precise definition challenging. Whether scientific realism is defensible, then, is contingent on the specific construal of the position. Broadly, definitions of scientific realism fall into one of two types: those that describe the *epistemic aims* of scientific inquiry (what I call the modest form), and those that describe the *epistemic achievement* of scientific theories or models (strong form).[3] At the core of the debate surrounding the former type of scientific realism is the question: Should science be seen as aiming at an accurate description of reality?[1] Scientific realism of this type holds that it *does* makes sense to think that science aims at describing the real structure of the world we live in.[2] A proponent of this viewpoint acknowledges that science has other aims – improving technologies, predictive accuracy and engineering capability – but the aim of accurate representation of reality by science is fundamental to this position. In contrast, the stronger (epistemic achievement) definition portrays scientific realism as a position concerning the actual epistemic status of scientific theories, or parts of theories.[3] Definitions of this type most commonly portray the realist as having belief in the truth or approximate truth of scientific theories, or believing that science contains successful references of theoretical or abstract terms to (observable and unobservable) phenomena existing in the world. So, defined in this way, the scientific realist is committed to a much stronger epistemic claim: our best scientific theories yield knowledge about aspects (both observable and unobservable) of the world. Important to note is the possibility of different beliefs about which aspects of science (e.g., entities, structures) represent reality.

The delineation between types of definitions of scientific realism is important, because much of the debate over realism becomes unnecessary if we allow both definitions to be clumped under the label ‘scientific realism’, as the modest version is immune to many of the antirealist objections.

The terms 'modest and 'strong' used thus far suggest there is an epistemic continuum, for scientific realists, in which one can fluctuate between Popperian skepticism about scientific knowledge and full belief that our current scientific theories are true. However, there is the implication that if one has *any* sort of belief in some aspects of science being approximately true, which for many is the motivation for the realist position, then this leads to some form of the strong scientific realism. To elaborate- if one believes that science *succeeds* in its aim in some regard, be it a correct mathematical description of a structure in nature, or compelling evidence for the existence of an entity like the oxygen atom, then one has adopted an epistemically positive attitude toward this aspect of scientific output (a commitment only made in the strong form), and therefore will have to either adopt the strong form entirely or give up belief in that specific aspect of science and return to skepticism. Furthermore, an entirely skeptical attitude towards science's epistemic achievement is indicative of a deeper epistemological skepticism about knowledge in general, especially of things we cannot directly observe, and is rather a form of empiricism masquerading as a form of 'scientific' realism. For these reasons, I will from here on only consider the strong form of scientific realism ('realism' for brevity).

Realism's commitments can be usefully divided into three dimensions: one metaphysical, one semantic, and one epistemological.[3] Metaphysically, realism is committed to a view of the world that has, in part, features that are mind- and language-independent and unobservable. Semantically, the realist must interpret scientific claims literally, in contrast to instrumentally; for example, subatomic particles and quantum fields must be taken to have truth values of their own rather than being instruments that produce observable phenomena that then have truth values when tested. Epistemologically, the realist is committed to some sort of *correspondence* relationship between aspects of science and the world that are, at least, approximately true. A natural motivation for some type of realist perspective is known as the 'no-miracles argument' and is based in the claim that realism 'is the only philosophy that doesn't make the success of science a miracle'.[2] Given the predictive validity, successful application, and often awe inspiring precision that some of the best current scientific theories provide, it would be miraculous that these theories didn't somehow accurately represent aspects the world. As Worrall has noted, the no miracles argument cannot *establish* realism, it only motivates the position intuitively.[4]

The criticisms I will discuss, and defend realism against, fall under three categories: the underdetermination of theory by data, skepticism about inference to the best explanation, and the pessimistic meta-induction. The problem of underdetermination of theory by data is often associated with forms of traditional empiricism, and holds that there will always be a range of alternative theories compatible with all the evidence or data we have, and perhaps a range of alternative theories compatible with all possible evidence.[2] Consequently, we never have any reason for choosing one theory over another, as no empirical measurement can differentiate one as being a more accurate representation of reality. This criticism also draws attention to the role auxiliary hypotheses and our ideas about confirmation play in evaluating scientific theories; different amendments to the beliefs about testing or the background assumptions of a theory can make it fit the data. This is problematic for realism especially when considering theories that are both empirically valid with concern to observable phenomena, but which rely on or posit different unobservable aspects. van Fraassen's constructive empiricism is an alternative, that remains agnostic about the truth of unobservable parts of theories partially for this reason. To defend realism against this, I rely on part of the objection itself: the variability of what our ideas about data and auxiliary assumptions do to our conceptions of testability and confirmation. It is true that what constitutes evidence has changed over time, but this has largely been due to increases in experimental ability and technological improvement regarding scientific research. Empiricism draws the line of what can be empirically validated at what our senses can perceive, and this distinction is misguided. The limit of our ability to interact with the real world is constantly being altered: first we used glasses to correct vision, then lenses for telescopes, then satellites for images, next x-ray and infrared cameras, then electron microscopes, etc. Are none of these tools a valid extension of human perception? The strict demarcation of what is considered reliable human perception is untenable for this empiricist attack, and realism remains justified.

This dispute is closely related to that of another common gripe with realism – the issue of inference to the best explanation. We seem to judge which theories are superior to others based on certain criteria grounded in explanatory ability. Even if we have pragmatic or otherwise reasonable grounds for choosing one theory over another, what reason do we have for claiming the theory is actually true? This problem can be resolved by considering the type of knowledge scientific realism purports to have. Structural realists believe that it is the structure of the world that science is representing, and this is often done mathematically in addition to theoretical frameworks. The description of the structure of the world provided by a mathematical theory is taken to be true when it corresponds to the observable phenomena we experience with a very high degree a precision. The truth in the theory then is a representative one – we have developed a theory that accurately represents reality. To refute this, one must initiate the larger debate about the role of explanation versus description when deriving knowledge and that debate encompasses all the alternative views in addition to realism, hence not being specifically adequate to reject realism in isolation.

The last objection to be considered is the pessimistic meta-induction. It states that if one considers the history of scientific theories, one sees a pattern of swapping out old theories for new ones, as time progresses. The newer theories are held to be better, and generally considered an accurate description of the world, whereas the previous theories are false. Therefore, by induction, theories at any given time, including the present, will ultimately be replaced by future theories that prove the present understanding to be false. A compelling and satisfactory response to this is given by many structural realists, that point out that the history of science is also filled with continuity of the structure or relationships between things in the world, even if the content or entities that were posited at the time were misguided. Worrall recounts the mathematical similarity and accuracy of Fresnel’s equations of light to those of the later Maxwell, despite Fresnel’s incorrect idea of an ether.[4] Many such instances of structural continuity can be seen as early and partially successful attempts at uncovering relations in the world, instead of simply false theories, leaving realism as a valid standpoint.

References

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