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Is Entity Realism the right way to think about Scientific Realism?

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Introduction

Ian Hacking's entity realism is influential in the scientific realism debate and maintains realism concerning manipulatable unobservable entities while retreating to an anti-realist position regarding the scientific theories and structures (Hacking 1982). It is an alternative compromise position to John Worrall's structural realism, which makes the opposite concession. Entity realism improves the realist's position in light of some anti-realist arguments but faces additional issues of its own.

David Resnik criticises entity realism as entailing the same epistemological burdens as standard scientific realism. He argues Hacking must rely on a traditional success-of-science argument, entities depend on theories after all, and experimentation is not as theory-free as Hacking claims (Resnik 1994). Resnik's concerns are legitimate, but he leaves out significant nuances. Martin Carrier instead cites past purported entities that have since been rejected while arguing for kind-realism (Carrier 1993). I cast Hacking's arguments as better suited to a limited structural realism, which I then defend against Carrier's claims. The result is a limited structural realism that can be supported by both Hacking and Carrier's arguments.

No-Miracles and Reliance on Theory

Resnik's first criticism is that entity realism, like standard scientific realism (SSR), relies on inference to the best explanation (IBE). It is useful to consider how the two arguments are different. A common response to the no-miracles argument (NMA) for SSR is that false theories can yield approximately true consequences. This is convincing and undermines SSR. However, the entity realist's NMA concerns experimental success rather than empirical prediction. It is easier to believe that our model of the universe is still quite far from the truth, than it is to believe that we can think we are handling atoms or DNA when we are not. Given that most philosophers of science at least acknowledge the strength of the standard NMA, entity realism's NMA is at least equally convincing and must be separately argued against by anti-realists since it is materially different.

Another common objection to entity realism is that entities are embedded in theories, so Hacking must appeal to theories after all. The most common response is to claim that success in experimental use can be sufficiently justified using low-level generalizations, and full-blown scientific theories are unnecessary. Such generalizations might entail shared beliefs about an entity's properties that do not amount to a full-blown theory. This then requires a demarcation that Hacking does not provide, but intuitively there is indeed a difference between a full-blown quantum mechanics theory and the general properties of electrons that are required when interacting with them, such as that they have a negative charge.

Causally Necessary Structure

My suggestion is to again grant Resnik's objection, and instead expand entity realism to include those parts of structure that are essential to the causal manipulation of entities (which we may call causally necessary structure or CNS), and nothing more.[1] I once again rely on IBE, but I do not make a stronger claim than Hacking does, since if the PEGGY II experiment he cites would be a miracle if electrons did not exist, it would equally be a miracle if the CNS of electrons was not true, for example if they did not occupy shells around atoms.

[1] I grant Resnik's objections to Hacking's denials that entity realism depends on either theory or a no-miracles argument.

Moreover, it becomes evident that Hacking's arguments are in fact better suited to a causally necessary structural realism (CNSR). In establishing his thesis, Hacking writes that we can consider something real when its "causal properties are sufficiently well understood that they can be used to interfere elsewhere" (Hacking 1982, 1143). If "interference" is the "stuff of reality", is it not the case that the causal structure itself is what has been established (Hacking 1982, 1144)? For example, the success of PEGGY II would be a miracle if the CNS that we intuitively associate with electrons was not real, but it does not follow that electrons themselves should therefore be real. That may be likely, but the required CNS could be a combination of other entities instead, as Resnik's example of Mendelian genes shows (Resnik 1994, 1167). Making the misguided step from CNS to entities has exposed Hacking to a lot of unnecessary criticism. As we shall see, phlogiston is another example of a purported entity that damages entity realism but not necessarily CNSR.

Note that an entity's CNS is always a proper subset of a full-blown scientific theory, so its qualifier is not vacuous. An apt analogy is that necessary structure is always within the immutable hard core of a scientific research programme (SRP), using Imre Lakatos's account of the scientific method (Lakatos 1977). While Lakatos does not provide a clear demarcation between an SRP's hard core and its mutable protective belt, consider that a hard core is much more stable than a protective belt, which in modern science is ever-changing. Since the CNS required for a past successful experiment does not constantly change, it cannot entail a theory's entire protective belt, so it cannot entail a full scientific theory.

Resnik's third argument is that experimentation is not as theory-free as Hacking supposes. It seems to be a short aside. In any case, the "common core" of theories between experimenters and theorists may be accounted for by CNS, and Resnik does not suggest that experimenters themselves are theory realists (Resnik 1994, 1169).

The upshot is that Hacking's entity realism is not as "traditional" or "theoretical" as Resnik claims (Resnik 1994, 1170). In particular, the materially stronger no-miracles argument must be independently criticised by anti-realists. Hacking's ideas survive Resnik's objections, but they support CNSR rather than entity realism after all. In the remainder of this discussion I show that, unlike entity realism, CNSR can also be supported by the traditional arguments for realism that Martin Carrier advocates.

Theory Change

Unlike Resnik, Martin Carrier attacks entity realism (and theory realism) directly. His strategy is to establish retention across theory change and explanatory power (invoking the standard NMA) as necessary and sufficient for realism, and then show that "at most" only his kind-realism is epistemically justified (Carrier 1993, 1187).

Carrier objects to entity realism based on the examples Larry Laudan uses for his pessimistic meta-induction (PMI) argument against standard scientific realism. The three most commonly discussed examples are Fresnel's ether, the phlogiston theory, and the caloric theory of heat. Carrier considers the foremost as illegitimate grounds for criticizing either standard or entity realism, since the ether was not essential to Fresnel's empirical success (Curd 2013, 1270). He does consider the caloric theory an issue for theory realism, but for entity realism he focuses only on phlogiston.

Carrier cites Georg Ernst Stahl's "manipulation" (in Hacking's sense) of phlogiston-rich charcoal to extract sulphur from sulphuric acid. While phlogiston as an entity has since been rejected, Carrier's claim is that kinds were retained and can explain Stahl's success. In particular, combustion and calcination are of the same kind as they "both constitute oxidation processes;" Stahl was "only wrong in taking what is actually an oxygen transfer from sulphuric acid . . . to charcoal to be a phlogiston transfer in the opposite direction" (Carrier 1993, 1185). Among theories, entities, and kinds (Carrier's "three possible

candidates"), indeed only the last is retained (Carrier 1993, 1187). However, CNS may have been as well: Carrier's own wording is that a "phlogiston transfer" became an "oxygen transfer", so quite literally the causal process of oxidative "transfer" was retained. On Carrier's other criterion, "transfer" is a better explanation of Stahl's empirical success than simply things being "alike" (Carrier 1993, 1185).

Carrier's account of phlogiston has been criticised by some as "special pleading" (Curd 2013, 1273). Scientists are fallible and, if not phlogiston, there will be some theory that is strongly successful yet does not retain kinds or CNS. An alternative argument is that the PMI relies on too few examples to ground a successful induction, which has been extensively argued. My suggestion is simply that phlogiston is not a reason to prefer kind-realism over CNSR, from which it follows that Carrier's traditional argument for kind-realism ought to equally support CNSR.

Conclusion

Ian Hacking's arguments for entity realism are a good way to think about scientific realism. They are not equivalent to traditional arguments for theory realism, as David Resnik claims, and require independent criticisms yet to be proposed. However, they ultimately imply a realism of precisely causally necessary structure rather than of entities, where the former is weaker than theory realism. A realism of causally necessary structure can survive Martin Carrier's attacks where entity realism cannot, and it is thus the best of all worlds: epistemologically more justified than theory and entity realism, yet just as safe as kind-realism.

Bibliography

Curd, Martin, Cover, J. A., and Pincock, Chris, eds. *Philosophy of Science: The Central Issues*. New York: W. W. Norton & Company, Inc., 2013. Print.

Lakatos, Imre. "Science and Pseudoscience." Curd, Cover and Pincock 20-26.

Hacking, Ian. "Experimentation and Scientific Realism." Curd, Cover and Pincock 1140-1155.

Resnik, David B. "Hacking's Experimental Realism." Curd, Cover and Pincock 1156-1171.

Carrier, Martin. "What Is Right with the Miracle Argument: Establishing a Taxonomy of Natural Kinds." Curd, Cover and Pincock 1172-1190.