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Small-r realism: How Scientific Realism can Accommodate Inductive Fallibility

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Fallible inductive inferences from experience are our sole means of ascertaining the truth of contingent propositions of a science and cannot give an absolute assurance of truth. Antirealists incorrectly amplify this fallibility into a complete inductive skepticism. Scientific realists are repeatedly tempted to evade this fallibility and seek stronger assurances of truth. Small-r realism offers a mediating position. It asserts that our epistemic means in inductive inference are powerful enough to lend very strong support to the contingent propositions of a science. Whether any science has secured such support, however, is not within the reach of any general principle, but must be assessed on a case-by-case basis for each science.

1. The Problem Posed by the Realist Intuition

The intuition behind scientific realism is that our best sciences have enjoyed enormous success in discovering how the world truly is. It is an intuition I share. I would like to see a precise expression of this intuition in our philosophy of science. We must ask: precisely what constitutes that success? That our best theories are true? The challenge for this project is that inductive inference, our sole means of ascertaining the truth of the contingent propositions in any science, is fallible. It follows that there is always a chance, even if very small, that our best supported sciences err. Inductive fallibility precludes a simple assertion of truth.

The present proliferation of formulations of scientific realism seeks to evade or diminish this danger in many ways.[1] None succeed. Consider the attempts. Instead of attributing truth to our best scientific theories, we might merely attribute approximate truth to them. That merely tells us that something is right and something is wrong in the theory, but not which part is right and which wrong. We might formulate scientific realism as a claim of the referential success of the terms of a theory. Inductive fallibility applies here as well. We might err in attributions of referential success.

Broadening our scope, we might formulate realism as the view that the aim of scientists is to attain the truth and the assurance that they will eventually secure it through a sequence of ever improving theories. That someone has an aim is no assurance that it will be secured. That truth will be attained eventually is an open-ended promise with no specified termination time. It may never be fulfilled and is little comfort for those of us who want truth now. We might formulate scientific realism as a belief by scientists in the truth of our best science. Once again, that someone has a belief does not make it a truth.

Selective realisms seek to limit attributions of reality to selected elements of a theory that, it is hoped, are more secure and more likely to survive theory change. The selected elements might be the theory's structure; or its tool-like entities; or those elements that are indispensable to explanations. The fallibility of inductive inference persists and we still can err in our identification of all of these selected elements.

Inductive fallibility is inescapable. The scientific realist's fear is that a too ready admission of inductive fallibility opens the door to antirealism. For antirealists are eager to amplify a small uncertainty in a scientific result into complete skepticism. Behind it lurks the pessimistic meta-induction. Our history of science shows repeatedly that our confidence in past theories was proven mistaken, when new theories replaced them. Can we be so confident now of our presently best theories?

[1] See Chakravartty (2017) and Ladyman (2023) for surveys of scientific realisms.

2. small-r realism

These are enduring problems for scientific realism. My proposal is that scientific realism can escape all these difficulties by paying closer attention to the original realist intuition. It divides naturally into two parts:

- Our epistemic resources are powerful enough to inform us of the deeper truths of science.
- Our present sciences have used these resources effectively to learn these truths.

The key to escape from the difficulties just reviewed is to accept that there is a limit to how much scientific realism can achieve by formulating a general principle, applicable to all sciences. The divided intuition tells us where that limit is found. We can make a general assertion about the reach of our epistemic resources. To say more, I argue below, is to breach the limit of what can be asserted generally. Once that limit is passed, judgments of success in science must be made on a case-by-case basis.

As a small-e empiricist, I hold that our sole epistemic resource for the establishment of the truth of contingent propositions in a science are inductive inferences or relations of inductive support. It follows that the first part of the realist intuition can be given a general and serviceable formulation:

> *small-r realism*: the propositions of experience can provide inductive support for the truth of the contingent propositions of the sciences. This inductive support may be very strong, but can never rise to absolute certainty; and no other means can provide that certainty.

The label "small-r" reflects that this version of scientific realism retracts from stronger version to a milder and more sustainable view.

Attempts to go beyond the first part of the realist's intuition and find a *general* formulation for the second part cannot succeed. For the inductive support of even our best sciences is, by definition, fallible.[2] It follows that there are scenarios in which even our best supported sciences can fail. We might seek a further general principle that would tell us which of our sciences or which parts of them are immune to such failures and which are not. That, however, would be to divine an additional principle of inductive logic that gives us deductive certainty. Since inductive inference is, by definition, fallible, there can be no such general

[2] If an inference is infallible, it is deductive.

principle. The second part of the realist's intuition cannot be implemented in a general principle. The extent of the success of any science must be determined on a case-by-case basis and must always provide for the chance of failure, even if that chance is remote.

Thus, the formulation above of small-r realism is not the full extent of scientific realism. It is only its fullest extent that can be expressed as a generally applicable principle. Small-r realism continues by examining the inductive support from experience of individual sciences on a case-by-case basis. Some will fall short. Others will be found to be strongly supported by experience. They are the celebrated successes behind the scientific realist's intuition. No matter how strong the inductive support, the fallibility of inductive inference persists, even if an error is extremely unlikely.

This formulation of scientific realism may now appear diluted in its ambitions. It is, however, reminiscent of how scientific realism was formulated originally in the mid-twentieth century, when the present debate over scientific realism was initiated. Versions similar to it can be found in Smart (1963, p.27) and Boyd (1973, pp.1, 3). Boyd wrote, for example: (p.1)

> By scientific realism I mean the doctrine that the sort of evidence which ordinarily counts in favor of the acceptance of a scientific law or theory is, ordinarily, evidence for the (at least approximate) truth of the law or theory as an account of the causal relations obtaining between the entities quantified over in the law or theory in question.

In this formulation, small-r realism repudiates antirealism, for antirealism depends on a skepticism about inductive inference itself. Sometimes the skepticism is explicit, as is the case with van Fraassen's widely known antirealism.[3] Sometimes it is not. The import of the pessimistic meta-induction[4] is a blanket skepticism about the inductive support for our present sciences. We are supposed to conclude that its inductive support will always fail to secure the truth, no matter its apparent strength.

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[3] Van Fraassen wrote: (1985, p. 295) "Inductive logic is a make-believe theory; no one has ever written its principles. Attempts to do so have always landed in incoherence or fallen afoul of hilarious counterexamples."

[4] A notable formulation is Laudan (1981).

3. Accommodating Fallibilism

Accepting inductive fallibility is not a concession of inductive skepticism. It is just to accept the ampliative character of inductive inference. The fallibility is a defining characteristic. If it was an inference form that guaranteed the truth of its conclusions, it would be non-ampliative and thus deductive.

Inductive fallibility is quite compatible with a contingent proposition in a science enjoying very strong support, so that it is quite unlikely to turn out to be false. The difficulty is that we have very many such propositions across the expanse of science. Eventually, somewhere, the quite unlikely will happen. It has happened. In spite of the earlier, very strong inductive support for classical physics, it was found to err through the emergence of relativity and quantum theory at the outset of the twentieth century.

While recognizing the ever-present possibility of error, we have no alternative but to accept the truth of the very many, strongly supported contingent propositions of the sciences. When the support is very strong, we should accept it on pain of inductive irrationality, that is, on pain of denying the dictates of reason, as given by inductive logic. That one among the very many may prove to be false is no basis for becoming inductive skeptics and refusing to accept the truth of the many. For we commit the far greater error in believing none of the very many, than we do in mistakenly accepting the one rare exception that proves to be false. We impose a needless blanket ignorance on ourselves out of fear of a rare error.

In this way, scientific realism can accommodate the fallibility of inductive inference. The fallibility is asserted within the statement of small-r realism. It is not denied or sought to be evaded. Whether there has been an inductive failure in some particular science lies outside the the general principle asserted by small-r realism. It is a decision to be left to examination of the individual sciences on a case-by-case basis. Such failure is possible in any science and ineliminably so, even if rare. It is an inescapable artifact of our inductive methods.

It is hardly debilitating to science to accept this fallibility and the unlikely chance of falsity in any specific case. We accept this fallibility routinely in ordinary life and there is nothing especially perilous in doing so. A 20-year-old can, on average, expect to live a further

55.63 years.[5] That is 20,319 days. Each day, that person can make an inductive inference to the conclusion that this day is not their last. The inference will, on average, yield a correct conclusion 20,318 times and an incorrect result once.

4. Attempts to Evade Fallibilism

Small-r realism adopts what I believe to be a sustainable intermediate view that preserves the best of two extremes. It accepts the antirealist claim that even the best inductive support for a science is fallible, but it rejects the antirealist skepticism about inductive inference. It accepts a strong scientific realist's insistence of the success of much of our best science, but resists an absolute assurance truth.

To see more details of this mediating position, this section will consider some ways that that a scientific realist might try to breach the fallibility of inductive inference. The outcome will be the same, in each case, and also for other attempts to breach this fallibility. In so far as they accept the fallibility of inductive inference, they proceed within the confines of small-r realism. In so far as they seek to breach inductive fallibility, they fail.

A common formulation of scientific realism retracts from a declaration of truth to one of approximate truth. We are assured that our latest, best theory is least approximately true. If all that is asserted is that its inductive support is fallible, then it remains within the compass of small-r realism. If it asserts more, it is quite opaque as to what that more is. If the assertion of approximate truth tells us that something is right in the theory and that something is not right, it does not identify which part is right and which not; and it cannot do so without giving assurances the exceed what fallible inductive support can sustain.

Selective realisms suggest that only some parts of a scientific theory deserve realistic construal. That part may be the theory's structure, its tool-like entities or its explanatorily indispensable elements. Each of these proposals are troubled by their own, specific shortcomings and they have been explored extensively in the existing literature. For present purposes, they share a common failing. If all that they assert is that we have strong but fallible inductive support

[5] Statistic for 2022 from US Social Security Administration.
https://www.ssa.gov/oact/STATS/table4c6.html

for the particular elements they designate, then they are proceeding within the bounds of small-r realism. Matters are otherwise if they assert a final truth for these elements; or assure us that the selected elements will persist through changes of theory. For inductive inferences are the only means of supporting such claims and it cannot deliver such absolute assurances.

There is also an anti-inductivism in selective realism. Most well-developed theories have good inductive support for all parts of the theory, not just the selected elements. Selective realisms, especially structural and entity realisms, require us *pre-emptively* to discount that evidence as supporting a realist construal of the unselected elements.

Hoefer's (2020) "tautological scientific realism" takes the right approach, I believe, in assessing the sciences case-by-case. Present quantum theory, he quite correctly reports, is not yet ready for realistic construal, where modern chemistry is ready for it. This favoring of chemistry derives from the inconceivability of scenarios in which modern chemistry may fail, short of scenarios of radical skepticism. In so far as the assertion is merely that we have powerful but fallible evidence against those scenarios, then the analysis lies within small-r empiricism. If the preclusion present and future of scenarios now inconceivable to us is intended as a general principle, then it breaches the fallibility of inductive inference. For what is inconceivable today can become tomorrow's science, even if rarely, as the more bizarre parts of quantum theory show.

5. Attempts to Evade Inductive Import

Attempts by scientific realism to evade inductive fallibilism fail. Correspondingly, attempts by antirealists to evade the import of inductive inference also fail. The error is the reverse of attempts to evade inductive fallibility. It is to succumb to it and to abandon inductive inference wholesale. Some version of inductive skepticism provides the basis of most forms of antirealism. None are sustainable. That is, none are sustainable if we are to proceed rationally. That just means that we conform with the dictates of logic, which are, in this case, provided by inductive logic.

The thesis of the underdetermination of theory by evidence is a common justification for antirealism. In its strong form, it asserts that for any theory there are always competitors equally well supported by the evidence. It has long been recognized that this strong form depends on

considering only an impoverished relation of inductive support, simple hypothetico-deductive confirmation.[6] Another argument for antirealism depends on a false dilemma. We are asked to choose between an inerrant inductive inference and inductive skepticism. Since inductive inference is fallible, we are directed to the alternative, inductive skepticism.[7]

The most enduring argument for antirealism in the present literature is the pessimistic meta-induction. We are to infer from the failure of past scientific theories that were once thought secure to the failure of our present and even future theories. The argument is an inductive inference that has been criticized in almost all its aspects. It fails as a generalization since it depends on generalizing from historical cases that are no longer representative of present conditions; and worse we are to generalize from cases chosen because they manifest the result desired.[8] The argument form of generalization is itself inapplicable since there are no suitable background facts that authorize its applicability.[9] In my view, the most serious failure is that it asks us to discount the evidence for present science without even considering that evidence. That we have been mistaken in the past in our judgments is grounds for caution. It does not override the inductive import of the mass of evidence now available for our present best theories.

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[6] For more, see Norton (2008).

[7] I believe this false dilemma is the basis of an argument that Chang (22, pp. 2, 6-7) mounts for his antirealism, misnamed as "realistic realism."

[8] See Mizrahi (2013) for details.

[9] See Shech (2019) for details.

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