Evaluating an Objection to Anti-realist Historical Induction Arguments

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1. Introduction

In a recent essay defending a realist view of scientific theories, Jarrett Leplin addresses the class of antirealist arguments making use of inductions over the history of science. These arguments are typified by the "pessimistic meta-induction," which impugns the truth of current, successful theories based on the falsity of past successful theories. Leplin lists a number of objections to this line of argument, including one objection otherwise absent from the literature: historical induction arguments produce an epistemological paradox. Leplin argues that to refute our current, first-order evidence for the truth of theories using second-order evidence about past theories results in a contradiction; this clash between first- and second-order evidence is illustrated by the preface paradox. Noting that the typical solution to this paradox would strongly undermine scientific practice and hence be unacceptable in the context of philosophy of

science, Leplin deems the paradox indefeasible and historical inductive antirealisms refuted. As this conclusion is suggested by Leplin only in passing, in this paper I will review his statements and restate his claims. I will review the preface paradox and the solution which Leplin rejects; I will then examine other solutions to the preface paradox, arguing that the preface paradox is not fatal to scientific practice, as Leplin suggests. On these grounds I will conclude that Leplin's overall argument dissolves, and results in nothing more fruitful than a struggle between preexisting intuitions.

2. Historical Inductive Anti-realist Arguments

Some of the most compelling arguments in the scientific realism debate are anti-realist arguments derived from inductions over the history of science. These "effort[s] to extract philosophical mileage from the history of science," in P. Kyle Stanford's words (2001, S8), seek to impugn our current epistemic position by showing that the same position has proven insecure time and time again through history. Our current position regarding the truth of our theories is supported by observation—we may have no disconfirming observations whatsoever—yet from an entirely different source, the history of science, comes evidence that our epistemic position is not so secure. Arguments in this broad class have been termed "pessimistic meta-inductions." The two such arguments that I will examine here are Larry Laudan's truth-success formulation of the pessimistic-meta induction and P. Kyle Stanford's induction of underdetermination.

Laudan's formulation of the pessimistic meta-induction (1981) casts doubt on the link between a theory's success and its referential truth. Citing many historical examples, Laudan shows first that theories whose terms correctly refer to real entities are not always

successful, and second, that successful theories do not always correctly refer. The crescendo of his argument is a list of obsolete scientific theories, coupled to the claim that "[t]his list, which could be extended *ad nauseam*, involves in every case a theory which was once successful and well confirmed, but which contained central terms which (we now believe) were non-referring" (1981, 33). The implication here is that our current evidence for the truth of contemporary theories is trumped by historical evidence stating that the same reasoning has failed many times in the past.

Stanford's induction of underdetermination takes a similar tack, applying historical induction to the problem of underdetermination of theories by evidence. Stanford claims that typical arguments for undeterdetermination "simply exchange underdetermination for familiar philosophical chestnuts" (2001, S1) failing to provide convincing examples of occasions where multiple genuine theories (not, for example, algorithmically generated ones) existed in a state of underdetermination by the existing evidence base. To fill this gap, Stanford proposes the problem of unconceived alternatives, generated by "our repeated failure *even to conceive of* alternatives to our scientific theories that were nonetheless both well confirmed by the evidence available at the time and sufficiently serious as to be ultimately accepted" (2006, 122). Drawing on the history of science, Stanford asks us to imagine a period shortly before the conception a new theory; during this time, the scientific community is in possession of a data base equally well confirmed by both their current theory and the yet-unconceived new theory. Arguing that this position has occurred frequently throughout the history of science, Stanford proposes a pessimistic induction of underdetermination (2001, S9). Observational evidence tells us that our theories are *not* underdetermined; that is, as far as

we can currently tell, our best theories have no genuine competitors equally well confirmed by available evidence. We have no alternative theories we can lay our hands on, thus, first-order evidence is against underdetermination. Historical evidence, however gives us good reason to think that equally well confirmed theories *do* exist, and that our theories *are* underdetermined by evidence.

At first glance, it seems reasonable that historical evidence, far broader in perspective than our current observations, should take priority, and make us doubt the truth of our currently held scientific theories. However, this problem of "contrasting evidence bases," in the words of Moser and Tlumak (1985, 135), threatens an epistemic paradox to which I will turn next.

3. Leplin's Objection

I will quote Leplin at length as he summarizes the situation so far and poses an objection:

> That systems of ordinary beliefs have proven to contain errors is second-order evidence for the erroneousness of current belief systems, none of whose component beliefs is currently individually impeachable. Am I to induce, from my record of fallibility, that some of my present beliefs are false, although the evidence favors each of them and I have no grounds to doubt any? If so, I am lodged in paradox. For in addition to believing that some of my beliefs are false, I am entitled to believe that all of them are true by the principle that epistemic justification is closed under conjunction. If each of these propositions is justified, so, by further

> application of this closure principle, is their self-contradictory conjunction, which is absurd. (2004, 123)

The paradox to which Leplin refers is the preface paradox of D. C. Makinson, in which the principle that justification is closed under conjunction leads to contradictory beliefs when combined with an assertion of human fallibility. Here, current observational first-order evidence favors belief in current theories; that is, each belief is individually justified, and since justification is presumed to be closed under conjunction, so is the conjunction of those beliefs. Yet the justification of the conjunction of our beliefs is impugned by historical evidence that tells us there are likely to be errors *somewhere* in our scientific doctrines; this leads to the paradoxical state of simultaneously believing the conjunction of our scientific theories and the negation of that conjunction.

Leplin anticipates, and rejects, one common response to this paradox: discarding the conjunction principle, and denying that many individually justified beliefs entail a justified conjunction of those beliefs.

> Partly for this reason, the closure principle for justification under conjunction is disputed within epistemology. But an anti-realism that purports to rationalize scientific practice cannot afford to dispute it. Without this principle, rational inference does not in general transmit epistemic warrant. For in general it is only in conjunction, not individually, that premises provide a basis for inference. […] Inference, often without prospect of independent empirical confirmation, is a frequent basis for extensions of science. (2004, 123)

Leplin asserts that science cannot exist without the principle that justification is closed under conjunction; science is built on inductive inference from conjunctions of independent facts, and its theoretical propositions are meaningful only in conjunction. While Leplin does not state this conclusion explicitly, it follows from his observations: if a denial of the conjunction principle is the only way to escape the preface paradox, then historical inductive anti-realist arguments lead to an inescapable contradiction, and fail. What bears further examination is whether the situation described by Leplin actually leads to the preface paradox, and if a denial of the conjunction principle is indeed the only solution. If these two conditions are true, then Leplin's objection should be a strong response to Laudan, Stanford, and others. In the next sections I will examine the preface paradox in more detail, provide three solutions that do not involve a denial of the conjunction principle, and discuss what effects these have on Leplin's view of the landscape of scientific realism.

4. The Preface Paradox

Makinson's preface paradox is so named because it is motivated by the prefaces of academic books, in which authors credit their colleagues for verifying that each claim is individually justified, but acknowledge that errors may exist in the conjunction of all the claims (Ryan 1991, 294). In a formulation of the preface paradox after Sharon Ryan (1991, 293-295), consider an author who has completed a lengthy book and believes each claim, having been checked by her colleagues, is individually justified:

(P1) $J(s_1) \wedge J(s_2) \wedge ... \wedge J(s_n)$

By the conjunction principle (CP), the author is therefore justified in believing the conjunction of her claims.

(CP) If *S* is independently justified in believing the members of some set of propositions at *t*, then *S* is justified in believing their conjunction at *t* also.

(P2) $J(s_1 \wedge s_2 \wedge ... \wedge s_n)$

Because *S* is fallible, it is reasonable to suspect that at least one of the claims represented in (P2) is false.

(P3) $J \sim (s_1 \wedge s_2 \wedge ... \wedge s_n)$

Further application of CP results in a contradiction.

(P4) $J((s_1 \wedge s_2 \wedge ... \wedge s_n) \wedge \sim (s_1 \wedge s_2 \wedge ... \wedge s_n))$

This represents a violation of the epistemologically prior "no contradictions principle" (NCP):

(NCP) No one is ever justified in believing a contradiction.

The violation of NCP constitutes the paradox.

It is important to note that this is not the only extant formulation of the preface paradox. While the paradox is frequently stated as resulting from conflicting evidence bases (Ryan 1991, Moser and Tlumak 1985), some authors deny this fact, insisting that true "preface cases" involve only the evidence represented by the propositions themselves (Douven and Uffink 2003). Leplin's objection, however, is very much a problem of conflicting evidence bases, and the stated formulation corresponds most obviously to his concerns. The propositions of (P1) represent a collection of theoretical propositions, each independently justified through empirical scrutiny, and conjoined by virtue of CP into a justified theory proper, (P2). (P3), the negation of the conjunction in

(P2), represents the fact that historical evidence, external to the claims of (P2), warrants justified *disbelief* in (P2). Since our theories have proven wrong time and time again, we are justified in disbelieving the conjunction of our current theories—there is assuredly some at least *some* error therein that will be brought to light in the future. By CP, we are therefore justified in believing both the conjunction of our theories and its negation, resulting in a violation of NCP.

As previously noted, Leplin implies that the only way to resolve the preface paradox is to deny CP, which has unacceptable consequences for an anti-realist account of the success of scientific practice. I will now cite three alternative solutions to the preface paradox, none of which require an outright denial of CP; I will then evaluate the implications each solution in the context of Leplin's argument.

5. Solutions to the Preface Paradox

A solution proposed by Sharon Ryan (1991) is to retain CP but to deny either (P1) or (P3) depending on the specific background of the case under consideration. For example, in the case of a human author who has written a long and complicated book and whose previous books have all contained errors, Ryan argues that there is no compelling reason to believe (P1) is true; "[i]t seems that thinking that this author's book contains all and only justified individual sentences is very unreasonable if the evidence for that claim is merely that she worked as hard as she could and her ideas survived the careful examination of even the very best critics" (1991, 300). A denial of (P1) results in a denial of (P2), and the paradox is resolved. However, Ryan considers another case, in which an author has written a very short and simple book, and rigorously evaluated each

and every claim; in this case, no matter the author's history of fallibility with similar books, Ryan states that the author should deny (P3)—that "under these weird conditions," there is no good reason to think that the book contains errors. When the claims under scrutiny are simple and few, Ryan maintains that any second-order historical evidence impugning the justification of their conjunction should be discarded in favor of the first-order evidence for their individual justification, which by CP, entails the justification of their conjunction. Here, again, the paradox dissolves.

Paul Moser and Jeffrey Tlumak view the preface paradox as stemming from a faulty view of probabilistic rational acceptance. They first present a naïve epistemic principle of rational acceptance (1985, 133):

(M1): *S* is justified in believing that *p* only if Prob(*p*) = *n* such that 0.5 < *n*.

They state that this principle gives rise to the preface paradox, since (in our formulation) (P1), (P2), and (P3) all have probabilities greater than 0.5. Their solution to the paradox involves the introduction of (2M1), a modification of (M1) (1985, 136):

(2M1): If *S* is justified in believing that *p*, then Prob(*p*) > Prob(~*p*), and

Prob(*p*) > Prob(any other proposition *q* competing with *p*).

Moser and Tlumak state that "a [competing] proposition *q* need not be a direct contradictory of *p*, having the form '~p'; it is sufficient that *q* be logically contrary to *p*. Thus, two propositions are competitors if and only if they are such that they cannot both be true" (1985, 130). In their resolution of the preface paradox, CP is not generally denied, but in cases of conflicting evidence bases, can be "overridden" by (2M1). Here, this amounts to weighing the relative probabilities of (P2) and (P3), which are in competition and cannot both be rationally accepted, and choosing one at the expense of

the other. With a sufficiently likely (P3), we may deny (P2), leaving no contradiction and resolving the paradox. This solution is similar to Ryan's, amounting to a case-by-case evaluation of background knowledge.

Igor Douven also views the preface paradox as a problem of unqualified rational acceptance. He begins by asserting a variant of (M1) (2002, 392):

(D1): *S* is justified in believing *p* at *t* if, according to *S*'s belief state at *t*, *p* has a probability exceeding the threshold value **t**,

where **t** is some value close to 1. His general statement of the preface paradox, which may be instantiated by a book with *n* claims, takes the form of the union of two incompatible sets of propositions (2002, 393):

PREF = {<claim *i* is true> | i:$1 \leq i \leq n$ } $\cup$ {<at least one claim is false>}

Douven rapidly concludes that (D1) is the origin of the paradox, and adds an additional restriction:

(2D1): *S* is justified in believing *p* at *t* if, according to *S*'s belief state at *t*, *p* has a probability exceeding **t**, and, in addition, *p* is not a member of a set of propositions that constitutes a Probabilistically Self-undermining Set (PSS).

Douven defines a PSS as a set of propositions in which a person "believes each proposition in the set to a degree exceeding **t** given her background knowledge at that time alone, but to a degree of **t** or less given her background knowledge plus *m* or more members of the same set (for some number *m*)" (2002, 396). When PREF constitutes a PSS, according to Douven's solution, *none* of the propositions contained in PREF can be

justifiably believed, failing the invocation of some other sufficiency condition, if one exists (2002, 397).

6. Implications for Realism

All of the solutions cited retain some form of CP; none resort to the outright denial that Leplin implies is the only escape from the paradox. In each case, the paradox is viewed as arising not from the closure of justification under conjunction, but from an inadequate thesis of probabilistic rational acceptance. Leplin asserts that giving priority to second-order evidence results in an epistemic paradox with no legitimate solution within the context of philosophy of science; this assertion proves false. We may now turn to the question of what implications these CP-retaining solutions have for the scientific realism debate.

The whole of our scientific theoretical knowledge is composed of a great many claims, each of which is apparently independently justified, impugned only by the historical knowledge of the fallibility of our methods. In a case like this, akin to a long and complex book with many propositions, Ryan's solution counsels us to disbelieve the equivalent of (P1); by her lights, there is no good reason to believe that each of our currently held theories is true. The vastness of the scientific enterprise and the compelling historical evidence impugning the conjunction of our claims should be enough to convince us that we are not justified in believing each and every one of our claims, despite their separate justification. The other prong of Ryan's solution, the case of a book with very few simple claims, is clearly not applicable to the realism debate. Taking Ryan's solution out of the preface paradox, we are left not with an indictment of

historical inductive anti-realist arguments, but rather with a confirmation of their claims—that the fallibility of scientific methodology is good reason to doubt our current theories, that is, if we are willing to place sufficient confidence in the strength of the historical argument.

As noted, Moser and Tlumak's solution allows CP to be "overridden" by the principle that a proposal's rational justification requires an absence of more probable competing propositions. In the case of scientific realism, we may consider the conjunction of our scientific theories to be the proposition in question; this can be rationally acceptable to us only if the competing proposition—the claim of historical inductive anti-realist arguments, that at least one of our theories is false, due to the doubt ascribed by the historical record—is less probable. Again, the direction of the judgment depends on the relative probabilities we are willing to assign to the propositions "the conjunction of our theories is true" and "the conjunction of our theories is false because of historically-generated doubts."

Douven places a similar further constraint on the thesis of rational acceptability; for him, the way out of the preface paradox is to insist that a proposition is only rationally acceptable if its proposition exceeds some threshold value *and* it is not a member of a PSS. However, Douven notes that whether PREF constitutes a PSS "cannot in general be answered; it depends on the various conditional probabilites of the propositions in the set given over propositions in the set" (2002, 397). Again, the threat of a paradox, and the judgment of whether or not the propositions are rationally acceptable, depends on the probabilities we assign them relative to the other members of the set.

The theme of the implications of these three CP-retaining solutions is that, far from the automatic dismissal of historical inductive anti-realist arguments that Leplin implies, the result of an examination of the consequences of giving priority to second-order evidence is rather unsatisfying. The outcome of the paradox situation in each case seems to be decided mostly by preexisting intuitions. Given Ryan's solution, a realist will assert that historical fallibility is not sufficient reason to discount current evidence; an anti-realist will assert the opposite and wish to deny the individual justification of current theories. The outcome of Moser and Tlumak's solution depends upon the relative probabilities assigned to (P2) and (P3); the realist and anti-realist will certainly assign the probabilities in the manner befitting their intuitions, and be unable to reach a consensus here. The assignment of probabilities of propositions in a PREF-like set given other propositions is not determined by Douven's solution; it is the assignment of these probabilities that determines the outcome of the situation, and without any clear guidelines for doing so, it will again simply be a matter of intuition. Like so many arguments in the scientific realism debate, Leplin's objection has thus turned out to be *not* a knockdown argument against historical induction arguments, but rather another fruitless clash of prior intuitions.

7. Conclusion

In this paper I have examined a suggestion by Jarrett Leplin that anti-realists attempting to impugn current theories using the historical record run afoul of the preface paradox. Leplin does not consider any solution to this instance of the preface paradox save a denial of the principle that justification is closed under conjunction; this solution,

he claims, is unacceptable for philosophy of science, as scientific practice requires the conjunction principle to increase its knowledge through inductive inference and the testing of claims in conjunction. Leplin thus suggests that this paradox forms a counterargument fatal to historical inductive arguments for anti-realism.

I have reviewed several other solutions to the preface paradox, all of which deal with a modification of the implicit thesis of rational probabilistic acceptance. In each case, the paradox is dissolved, but the nature of the resulting message for the realism debate is left to preexisting intuitions. As interpretation of the solutions for scientific realism requires the assignment of relative probabilities to the propositions "the conjunction of our scientific theories is justified" and "the conjunction of our scientific theories is not justified," Leplin's objection is readily dissolved and leaves us no further ahead than when we started.

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