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Problems with Popperian Corroboration

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ABSTRACT

Classical logicians tell us tautological statements are redundant. Typically, we prefer new information rendered from the premises. If one were a strict deductivist and claimed syllogisms were the only means by which one could be critically rational (a good thing), then we would want something other than mere tautological conclusions, if we adhered to these classical Greek claims. Allegedly, Popper's Hypothetico-deductivism (H - D) is entirely deductive. In his 1963 *Conjectures and Refutations*, he claims it is a myth that induction is even used. If a hypothesis survives a crucial test, it is said to be corroborated. Conversely, all these means is that it is *not falsified*. ~~P is equivalent to P. Corroboration, then, does not amount to much on its own. *Degrees of corroboration* are given conflicting accounts in his 1934 *Logic of Scientific Discovery*. In the case of Inference to the Best Explanation (IBE), a test may tell us to place faith in a theory over rivals, although antecedent context plays a more crucial role here than *modus tollens* alone. Popper's H-D must assume a method akin to IBE for his inferential pattern to give us new information. IBE and deduction are not the same. Throughout our analysis, we will see that Popper's account conjures Duhemian worries about underdetermination.

I. Introduction

Perhaps the greatest folly of the philosophy of science is to search for one commonality that describes the advancement of science. Even with the Kuhn cycle, ubiquitously the anomaly is responsible for falsification or negative instances of a theory.[1]These have been known to take down entire paradigms. Similarly, Larry Laudan and Leplin have argued that technology is responsible for breaking empirical ties (the microscope, telescope, etc.).[2]But we must not forget details such as that the theory of special relativity may have had its roots in pure intellectual achievement. Perhaps, broadly, scientific truth just takes time—admittedly an open-ended answer. Optimistically, if science were to continue, views would change due to the evolutionary nature of science. . .

But the important question would be: *is* there one, underlying "logic of scientific discovery" as the title of Popper's widely acclaimed book may suggest? No doubt, David Hume's concerns about induction may have had a hand in the search for one. Arguably, they have displaced the scientific method. But are philosophers seeing this correctly? Popperianhypothetico-deductivism(H – D) holds that hypotheses are brought forward and then tested. The hypothesis is a bold conjecture. He claims this account of scientific discovery is entirely deductive. Baconian induction, and in other cases "eliminative induction", holds that after observations are tabulated, the hypothesis is tested at the end. The conclusion is "induced" from the observation statements. Speaking of corroboration, Popper writes in the *Logic of Scientific Discovery*(*L.Sc.D.*):

My benevolent critic might reply that he can still see no reason why my C function should not be regarded as a positive solution to the classical problem of induction. For my reply, he might say, should be perfectly acceptable to the classical inductivist, seeing that it merely consists of an exposition of the so-called 'method of eliminative induction'—an inductive method that was well known to Bacon.[3]

A negative attempt to falsify serves a corroborating role, here. There is initially a bold conjecture, and on the other hand, the crucial experiment, which is the attempt to falsify it.

[1] ThomasS. Kuhn.*Structure of Scientific Revolutions*.(Chicago:University of Chicago Press, 2012).
[2]Larry Laudan and Jarrett Leplin, "Empirical Equivalence and Underdetermination,"*Journal of Philosophy*,88(1991):449-72.
[3]See e.g.,Karl Popper, *The Logic of Scientific Discovery*.(London & New York. Routledge Classics,2002):438.

Corroboration is the notion that Popper pits against falsification. This is the case when a theory passes a test. However, corroboration does not show us much, and if it does, Popper is unclear about what exactly it *does* show. *Degrees of corroboration* are given various conflicting accounts in *L.Sc.D.* as well as in *Conjectures*.[4]If a theory passes a test, it does not show that the theory is verisimilar, it shows that it passed that test. If Popper's theory is descriptive at all, it must take the form not of if p then q, ~q, therefore ~p.But it must take the disjunctive form: (p ∨ q), ~p, therefore q. Otherwise, we do not know where the theory stands concerning others, and it is only in the situation of empirically equivalent theories that we can get useful information. This is the syllogistic form of *modus ponendotollens*. He blatantly spells this out in his *L.Sc.D.*:

[T]he rule of preferring theories which are better corroborated than others [. . .] We can sometimes rationally justify the preference for a theory in the light of its corroboration, that is, of the present state of the critical discussion of the competing theories, which are critically discussed and compared from the point of view of assessing their nearness to the truth (verisimilitude). The current state of this discussion may, in principle, be reported in the form of their degrees of corroboration. The degree of corroboration is not, however, a measure of verisimilitude (such a measure would have to be timeless) but only a report of what we have been able to ascertain up to a certain moment, about the comparative claims of the competing theories by judging the available reasons which have been proposed for and against their verisimilitude.[5]

The disjunction of rival theories antecedently in competition looks suspiciously like IBE. Here, one starts with various conclusions, but there is only one theory that wins out. There are some debates about this, although generally considered at the time of this writing, IBE is a form of abduction, which was promulgated heavily by Charles Saunders Peirce in the late 1800's (although putatively it is attributed to Aristotle's *Prior Analytics*). It is in this more general sense that I appeal to IBE. Peirce writes: "Abduction is the process of forming explanatory hypotheses. It is the only logical operation that introduces a new idea."[6]It represents a third type of logic alongside induction and deduction. If IBE does serve an important role, which looks to be the

[4] His first blush attempt at a definition can be found on pp.248-249 of*L.Sc.D.* in which he calls the degree of corroboration the probability or the number of severe tests a theory can withstand.
[5]*L.Sc.D.*,p.281.
[6]Igor Douven, "Peirce on Abduction" *Stanford Encyclopedia of Philosophy.* (2011),<https://plato.stanford.edu/entries/abduction/peirce.html>.

case in that we antecedently start with empirically equivalent theories, then Popperian H – D is not entirely deductive.

II. Agreeable Tests

In contrast to IBE, Popper's H - D alleges that the scientific process starts with a conjecture, and scientists try to falsify it via a crucial experiment. This is the method of "trial and error".[7]If a crucial experiment fails tofalsify, they have a "corroborating" instance. Here is the logic describing a crucial test in isolation. Remember, they are looking for a falsifying (~) instance. In the case of a positive instance, we have:

P1. If P

P2. & ~~P (<---crucial experiment)

P

A simple illustration may help. I think I have brown hair and perform a crucial experiment by snipping a lock off with a pair of scissors. I look at it. It is not not-brown. Therefore, I have brown hair. Far from giving us new and novel information, we have committed ourselves to tautology. It may be also the case that I have proven that my shears work, or that I indeed do have hair or any number of auxiliaries. I could be color-blind. Popper himself writes: "Only if P is independent of some part of the system can we say that this part is not involved in falsification."[8]This calls to my mind Duhemian worries. It may be that my simplification and example somehow shortchange Popper. The point I wish to draw attention to is that an instance of corroboration tells us neither that a theory is true, nor verisimilar (what's more, he's bound to this). It shows that a theory is *not falsified*, which is tautologous to the assertion *that* P. If it is neither true nor false where do we stand about classical deductive logic? Can Popper's system be classically deductive at all?

To be sure, he says more, although certain passages hint we might not be far off the mark with our crude syllogism.

[7]"Theories are put forward tentatively and tried out. If the outcome of a test shows that the theory is erroneous, it is eliminated. The method of trial and error is essentially a method of elimination."*Conjectures and Refutations*. (London and New York: Routledge Classics, 2002): 421.
[8]*L.Sc.D.*, p. 85

An appraisal must, of course, be a synthetic statement—an assertion about 'reality'—in the same way as would be the statement 'Schrodinger's theory is true' or 'Schrodinger's theory is false'. All such statements say something about the adequacy of the theory"[. . .] As to the appraisal itself, this may either be asserted to be 'true', or it may, in its turn, be said to be 'probable'.[9]

It appears he does want to remain binaristic in some manner. In our example, we have just corroborated the theory once, the theory remains underdetermined.[10]If Popper's system is entirely rationalist and deductive, he will be bound to something like our example. Corroboration in the appendices in *L.Sc.D.* runs C(h/e) where C is not probabilistic.[11]In our example, the double negation is just what is under dispute. Forms of induction don't have this problem. These negative falsification problems do not occur, it may be alleged because his system is fallibilist. There can be a degree of imprecision attached to it. So, what are we left with? This does not rule out absurd answers, nor does it tell us probabilistically where we stand in terms of the phenomena we are trying to describe with our theory. We will find that he attempts to answer all of these concerns with his notion of *degrees of corroboration.*

III. The Modus Tollens Reply

Does Popper's H-D rely on a tautology for corroboration? Or am I performing a sleight of hand? We may also write the falsifying inference thus: "((t —> p).p) —> t, or in words: 'If p is derivable from t, and if p is false, then t also is false [. . .] Using this mode of inference we falsify the whole system (the theory as well as the initial conditions)."[12]This again seems to conjure Duhemian worries. This might be the logic of falsification, although as we have shown, the logic of corroboration follows a different path. As a strict "deductivist" tautological reliance is not classically understood to be very impressive according to standard interpretations of deductive logic, the alternative view is abductive.

Context plays a crucial role.*Modus tollens*runs: If P, then Q. ~Q. Therefore, ~P. Where Q is to be tested. In the case of an under-deterministic tie of possible alternatives, a disjunction of a set of

[9]Ibid., p.262
[10] We will see Popper encounters problems of his own in the appendices of *L.Sc.D.* He writes: By 'the problem of degree of corroboration' I mean the problem (i) of showing that there exists a measure (to be called degree of corroboration) of the severity of tests to which a theory has been subjected, and of the manner in which it has passed these tests, or failed them; and (ii) of showing that this measure cannot be a probability. . ." (p.405) He returns to this problem highlighting the incompatibility of degrees of corroboration with probability throughout the appendices. See e.g.*L.Sc.D.*,p.412.
[11]See e.g.,*L.Sc.D.* p.403.
[12]Ibid.p.56.

antecedent rival theories {t_1, t_2, t_3. . . }. From which arises the case wherein even a single case of corroboration can serve an epistemic function. Only with this antecedent disjunction of theories does corroboration in general yield new information. It is my contention, that this would make the method abductive and not deductive. For our crucial experiment to render new information, we must accept the disjunctive form. We also must keep in mind Duhemian worries and problems with corroboration as well.

In both texts, he flounders as to a precise definition. He spends less time on individual instances. This only complicates the matter for Popperian H -D. Far from being a rigid philosophical term, it seems, we wind up with a poorly defined fuzzy idea. On pages 248-249 *L.Sc.D.* he refers to the degrees of corroboration as the number of severe tests a theory can withstand, but also in a footnote: "by standing up to tests, the hypothesis becomes 'more probable' in the sense of the probability calculus."[13]These don't add up to the same thing. And on page 265 of *L.Sc.D.*, he writes that the degree of corroboration is related to how testable a theory is.[14]Later, in a footnote, he appears to endorse Bayes, which does not seem to be entirely in step with his critical rationalism at all. "It is conceivable that for estimating degrees of corroboration, one might find a formal system showing some limited formal analogies with the calculus of probability (e.g. with Bayes's theorem)"[15]Bayesian inference being purely inductive, this is a perplexing comment. On p. 281 he redefines his *degrees* yet again![16]"By the degree of corroboration of a theory, I mean a brief report that summarizes how the theory has stood up to tests, and how severe these tests were." This is the first mention of a report in the text, and on *L.Sc. D.* page 431, he says they may be assigned a numerical value. *Conjectures*is much clearer. Interest not in probability but in high degrees of corroboration is emphasized. But yet again, he introduces something new: "corroboration is the *severity* of various tests [my emphasis]."[17]

[13] In appendix vii he writes conversely that "it is further asserted that degree of corroboration cannot be a probability [. . .] a higher degree of corroboration will, in general, be combined with a lower degree of probability, which shows not only that we must distinguish sharply between probability (in the sense of the probability calculus) and degree of corroboration"*L.Sc.D.* p.374.
[14]On page 269 of *L.Sc.D.* he addresses some of these concerns. Testability, falsifiability, and the scope of a theory are all related. He intends degrees of corroboration to highlight this, although this definition is incongruent withprevious comments about degrees being related to probability.
[15]*L.Sc.D.* p.261.
[16]Ibid., p.281.
[17] *Conjectures*, p.385.

IV. CONCLUSION

Popper's notion of corroboration is a problematic concept. A single instance does not render new information from a purely Aristotelian point of view. The fuzziness surrounding it runs counter to deductive logic (e.g. his notion of verisimilitude vs. truth). *Degrees of corroboration* are given multiple definitions throughout the *Logic of Scientific Discovery*, as well as in *Conjectures and Refutations*. On some accounts, it receives a numerical value. In other places, it is a property a theory has to withstand tests or the severity of the tests themselves. More confusing is the switch between a probabilistic account, a non-probabilistic account, and a third account that looks suspiciously like Bayes' (which is inductive), yet is not probabilistic of its own accord.[18]In one place he calls them "reports".[19]It may be interesting to note that Lakatos' had a criticism similar to our own, only it is concerned with the falsification side of crucial experimentation.

If a theory is falsified, it is proven false; if it is "falsified" [in Popper's conventionalist sense], it may still be true. If we follow up this sort of "falsification" by the actual "elimination" of a theory, we may well end up eliminating a true and accepting a false, theory. (Lakatos 1978: 24).[20]

We would like to add that if a theory is corroborated by Popper's account, it might be still false. And as in the Duhem-Quine thesis, we do not know what in the web of beliefs is true (or even verisimilar). The ability to withstand crucial tests does not help us much if we stick to his comments in the *Logic of Scientific Discovery*. The reason for this is because of conflicting reports of what the degrees of confirmation are supposed to be. In the worst points in the appendices, it looks as if he is resurrecting Bayes, although the probability is ruled out in *Conjectures*. How should we conceive of these *degrees*? The answer to the riddle of how Popperian H - Dis is supposed to work might mention the antecedent disjunctive idea that is integral to abduction. I am unsure whether this move keeps hypothetico-deductivismdeductive, however. It might be added that to evaluate a theory as more corroborated than another may require an inducement.

[18] In *Conjectures*, he clarifies: "The degree of corroboration will therefore increase with improbability" p.150.
[19]*L.Sc.D.*, p.281.
[20]Steven Thornton, "Karl Popper",*Stanford Encyclopedia of Philosophy*(2022), <https.www.//plato.stanford.edu/entries/popper/>.

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