How Explanatory Reasoning Justifies Pursuit: A Peircean View of IBE

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Abstract: This paper defends an account of explanatory reasoning generally, and inference to the best explanation in particular, according to which it first and foremost justifies pursuing hypotheses rather than accepting them as true. This side-steps the problem of why better explanations should be more likely to be true. I argue that this account faces no analogous problems. I propose an account of justification for pursuit and show how this provides a simple and straightforward connection between explanatoriness and justification for pursuit.

1. Introduction

Most proponents of *inference to the best explanation* (IBE) take it to be a distinctive mode of non-deductive inference where *explanatory reasoning*, i.e. considerations concerning what would be a good or the best explanation of one or more phenomena, is used as a guide to theory choice. This form of reasoning, they hold, is in general a reliable, if fallible, guide to the truth of hypotheses.

The idea of an explanatory inference goes back to Charles Peirce who promoted an inference, which he called *abduction*, proceeding from the premise that a given hypothesis, if it were true, would make an otherwise surprising fact "a matter of course" (CP 5.189).[1] Recent scholarship has however emphasised that Peirce's mature account of abduction differs significantly from the contemporary notion of IBE.[2] Contemporary discussions usually assume that explanatory reasoning, at least in the form of IBE, can justify *accepting* hypotheses as (approximately, partially, etc.) true. They thus regard it as a species of inductive or ampliative inference. This view is often called *Explanationism*.

1 All references to Peirce (1932-58) are abbreviated: CP [volume].[paragraph number].

2 The following interpretation is defended especially clearly by McKaughan (2008). Cf. also Hintikka (1998), Minnameier (2004), Paavola (2006), Campos (2011).

While Peirce agreed that abductions should guide our choices of hypotheses, he only understood this in the sense of choosing which hypotheses to investigate further. Peirce held that only empirical investigations can justify accepting a hypothesis, insisting that abduction gives us no reason to regard a hypothesis as true, except insofar as it leads to subsequent empirical testing which the hypothesis passes. He did regard abduction as a form of inference which involves giving reasons (whether good or bad) and not, for instance, a mere heuristic for "discovery". However, these are reasons for *courses of action*, viz. subjecting hypotheses to empirical testing, rather than reasons for belief or acceptance (McKaughan 2008, 450 & 454).

In this paper I defend a view of the justificatory role in science of explanatory reasoning in general, and IBE in particular, along the lines of these Peircean insights.[3] Specifically, drawing on the distinction between acceptance and pursuit (Laudan 1977; Franklin 1993a), I propose to see explanatory reasoning as first and foremost providing justification for *pursuing* a hypothesis, as opposed to justification for *accepting* it.

The Peircean view defended here avoids what Peter Lipton (2004) calls *Voltaire's Objection* to explanationism: why should we regard a hypothesis as any more likely to be *actually* true just because it would be a better explanation if it *were* true? The Peircean view side-steps this problem since it requires no general connection between explanatoriness and truth. Furthermore, the Peircean view faces no analogous problem either. As I shall show, there is a simple and straightforward connection between good explanations and justification for pursuit, based on the kinds of "economical" considerations Peirce stressed as fundamental to abduction. I introduce Voltaire's Objection in Section 2 and explain why it poses a problem to explanationism. In Section 3, I present a

3 I do not claim this view to be the most plausible interpretation of Peirce's considered views on abduction, much less to capture everything Peirce ever wrote about it. I merely use it as a name for the view, inspired by Peirce, which I defend in the context of the contemporary debate.

general account of pursuit and then, in Section 4, show how explanatory reasoning can justify pursuit.

2. Voltaire's Objection

The slogan that one should infer "the best" explanation conceals an important distinction. For there are at least two senses in which an explanation can be better than its competitors, and these should be kept separate when evaluating explanatory inferences (Lipton 2004, ch. 4). In the first case, a hypothesis may be the *likeliest* explanation relative to the other competing hypotheses considered. The likeliness of an explanation has to do with truth – it is the explanation which we regard as most probably true, or closest to the truth, etc. For instance, we may be able to rule out, or make highly improbable, all plausible alternative explanations in light of the available evidence and accepted background theories. Here, the remaining explanatory hypothesis would be the likeliest available explanation, and in this sense the best. As Lipton is careful to point out, IBE is only interesting as an inductive inference to the extent that it goes beyond merely being an inference to the likeliest explanation. Since scientists generally aim to discover good explanations, if a hypothesis *H* is the likeliest available explanation of some otherwise surprising phenomenon, they would be justified in accepting *H*. For my purposes here, this is a perfectly cogent inference and nothing I say in this paper aims to challenge it.

The sense of "best explanation" that is of interest to explanationists concerns how good an explanation we would deem a hypothesis *H* to be, if it were true. Let us say that the *explanatoriness* of *H* is the amount and quality of the explanations *H* would provide, if it were true. Or, since the "goodness" of explanations is usually taken to concern how much understanding they give us, the explanatoriness of *H* can also be understood as the amount of understanding *H* could potentially afford us.[4] Assessing this requires subjunctive

4 Explanatoriness is my preferred term for what Lipton calls "loveliness".

reasoning, i.e. reasoning about what would be the case – viz. how much understanding it would provide – if *H* were true. We can call this kind of reasoning *explanatory reasoning*. What explanationists claim, then, is that explanatory reasoning can give us additional or independent reason to accept a hypothesis as true (or approximately true). In other words, they regard the explanatoriness of a hypothesis as a guide to its likeliness.

This claim is also what makes the explanationist account of IBE controversial. One question concerns what "good explanations" means. There are many different accounts of explanation (causal, unification, etc.), and these variably emphasise certain virtues (being simple, unifying, coherent, elegant, quantitatively precise, specifying a mechanism, etc.) as characteristic of good explanations. Since my argument in this paper does not depend on any particular view of explanation or of how they give us understanding (however we conceive of this), I stay neutral on these matters.

Explanationism however faces a more pressing problem – what Lipton (2004, ch. 9) calls *Voltaire's Objection*. As critics have pointed out, the fact that a hypothesis would be a good explanation of something, if it *were* true, does not, *prima facie*, seem to have any implications for whether it is *actually* true. Indeed, this seems worryingly close to a form of wishful thinking. So why should this give us any additional reason to accept the hypothesis?[5] Of course, like all inductive inferences, IBE would be fallible, and so explanationists should not be expected to *guarantee* its success. Nonetheless, they ought to provide some reason to think that explanatoriness is generally a reliable guide to likeliness or that it generally tends to take us closer to the truth.

My focus in this paper is however not on the arguments explanationists give for the reliability of IBE.[6] Rather, I restrict myself to showing that the Peircean view avoids Voltaire's Objection altogether and, furthermore, faces no analogous problems.

5 See Barnes (1995) for a sustained criticism along these lines directed specifically at Lipton.

6 See Douven (2011, sec. 3.2) for a brief overview.

3. Pursuing Hypotheses and Justifying It

In his exegetical study of Peirce's views on abduction, Daniel McKaughan (2008) distinguishes three general interpretations: the *Generative Interpretation*, the *Justificatory Interpretation*, and the *Pursuitworthiness Interpretation*. The Justificatory Interpretation corresponds to explanationism, where abduction is taken to provide justification for accepting hypotheses as true or approximately true. This view is typically contrasted with the Generative Interpretation, associated with Hanson (1958) (e.g. Paavola 2006). Hanson argued that it is a significant philosophical task to analyse the processes through which scientific theories are formulated, generated or discovered, promoting Peirce's abduction as such an analysis. Popper (1934/1959) and the positivists, he argued, were mistaken in restricting philosophy to questions of how evidence justifies the acceptance of theories, relegating all other issues to empirical sociology, psychology or history.

McKaughan argues that these two interpretations overlook an important step in the process of inquiry between the initial formulation of a hypothesis and its subsequent acceptance (or rejection) as part of established scientific knowledge. Apart from formulating and developing hypotheses to investigate, scientists, in order to prioritise their time, resources, and efforts, furthermore need to make decisions regarding which of these to investigate or develop further. In other words, scientists need to make decisions regarding which hypotheses are most worthy of further *pursuit*.[7] As McKaughan shows, this was a dominant theme especially in Peirce's later discussions of abduction – thus, the Pursuitworthiness Interpretation. It is this aspect of Peirce's views on which I draw in the following.

7 Pursuing a hypothesis is generally taken to involve at least two aspects: (i) subjecting it to empirical testing and (ii) developing it theoretically, e.g. clarifying it, resolving conceptual problems, or removing apparent tensions with other accepted theories (Laudan 1977; Whitt 1990). I focus on (i) in this paper.

The distinction between *accepting* and *pursuing* a hypothesis was first coined (in those terms) by Larry Laudan (1977, 108-14; 1980, 174). Laudan noticed that, historically, scientists have often chosen to work on scientific theories despite these having have major empirical and conceptual problems relative to the dominant views, citing, amongst others, Copernicanism, the atomic theory, and quantum mechanics in their early stages. By distinguishing between pursuing and accepting, Laudan argued, we can say that it was rational for scientists to pursue these theories even though there where strong reasons to accept competing theories. More recently, Allan Franklin (1993a, 1993b) argues that certain episodes in particle physics are best understood as cases where physicists chose to pursue hypotheses before they had reasons to accept them.

Franklin's case studies are especially suggestive for present purposes, since these concern hypotheses that were pursued exactly because of their potential for explaining otherwise puzzling phenomena. For example, Franklin (1986, ch. 1) discusses the rejection by particle physicists of the so-called principle of parity conversation. The puzzling phenomenon physicists faced was this: for a specific set of decay patterns, the principle that each particle has a unique mass indicated that these decays stemmed from a single particle, while the principle of parity conversation ruled this out. When the physicists T.D. Lee and C.N. Yang in 1956 proposed that parity conversation may be violated in weak interactions, and suggested experiments to test this hypothesis, it sparked an intense experimental interest. It should be noted, first, that the same hypothesis had earlier been suggested as a logical possibility, but without being proposed as a solution to the above puzzle and without arousing much interest (Franklin 1986, 29f). Second, many of the physicists involved were quite convinced that the experiments would falsify the hypothesis.[8]

8 Franklin reports (1986, 24) that Richard Feynman bet Norman Ramsey $50 to $1 that the experiments would fail to show parity violation – and ended up paying!

Apart from the descriptive point that scientist often actually do make and argue for decisions about which hypotheses to pursue, there are also normative reasons why scientists ought to justify such choices.[9] The reason is pragmatic: the resources available to scientists are scarce but human imagination is abundant. In Peirce's words:

> Proposals for hypotheses inundate us in an overwhelming flood, while the process of verification to which each one must be subjected before it can count as at all an item, even of likely knowledge, is so very costly in time, energy, and money—and consequently in ideas which might have been had for that time, energy, and money, that Economy would override every other consideration even if there were any other serious considerations. In fact there are no others. For abduction commits us to nothing. It merely causes a hypothesis to be set down upon the docket of cases to be tried (CP 5.602)[10]

In other words, scientists need to justify which hypotheses are worth investigating in order to prioritise their resources. Justifying pursuit is, essentially, a decision-theoretic problem of how to optimise the epistemic output of science.

Although justification for pursuit is motivated by practical or pragmatic issues, it is not wholly detached from epistemic matters. On the contrary, it is still concerned with how to best or most effectively achieve our epistemic goals. This also makes it slightly misleading to characterise the distinction as one between justification and pursuit. Although the two are sometimes conflated, the distinction between (justification for) accepting and pursuing hypotheses cuts across the much discussed distinction between

9 Further case studies of pursuit are discussed by Whitt (1990) and McKaughan (2008).

10 Peirce frequently connects “economical” considerations to his account of abduction. See McKaughan (2008, 452ff) for further references.

context of discovery/context of justification.[11] Choices regarding which hypotheses to accept as well as which to pursue can and ought to be justified. The difference is that acceptance concerns which hypotheses are more likely to be to true, given our background knowledge and evidence, whereas justification for pursuing hypotheses involves practical reasoning about which *courses of action to follow*, given our resources, overall goals, and available information.[12]

How do we decide which hypotheses we are justified in pursuing, then? To answer this we must first, as Šešelja, Kosolosky & Straßer (2012) point out, make clear what kinds of goals we are justifying pursuit relative to. If we are interested in a broader set of moral, political and epistemic goals (as e.g. Kitcher (2011)) we need to take things like ethical implications and technological progress into account. In this paper I am however focusing only on epistemic or intellectual goals such as learning the truth or getting better explanations or understanding. This focus also seems to be assumed by explanationists – ethical implications or potential technological applications are usually taken to be irrelevant to the explanatoriness of a hypothesis.

Given this focus, we are justified in pursuing that course of action we judge will bring us the closest to achieving our epistemic goals. Doing will typically involve, as McKaughan (2008) points out, somehow *weighing* and *ranking* the salient competing hypotheses in terms of factors we take to be relevant to determining this. What these factors are exactly will presumably vary somewhat from case to case, but some general suggestions can be made. Thus, Peirce highlights the "cost, the value of the thing proposed, in itself; and its effect upon other projects" (CP 7.220). Elaborating on Peirce, McKaughan

11 Laudan (1980, 174) characterises context of pursuit as a "nether region" between discovery/generation and (ultimate) justification. In my view, the "context" terminology is still misleading: these are not neatly separated phases or contexts of scientific inquiry. The distinction concerns different kinds of *choices*, which may overlap, and the kinds of *justification* relevant to them.

12 McKaughan (2008, 454); cf. Kapitan (1992).

mentions “our time, resources, and value of the estimated payoff in comparison to other courses of action … If we estimate that testing the hypothesis will be *easy*, of potential *interest*, and *informative*, then we should give it a high priority” (2008, 457). Independently, Franklin (1993a, 122) observes from his case studies that “[t]he decision to pursue an investigation seems to depend on a weighting of at least three factors; the interest of the hypothesis, its plausibility, and its ease of test”. He also mentions (1993b) more pragmatic concerns such as “recycling expertise” or being able to continue already ongoing research programmes.

This of course raises the question of how these factors should be weighed against each other. In practice, this will probably be a matter of informed judgement. But in order to clarify the underlying logic, it can be useful to think of it terms of decision-theoretic models of simplified or idealised situations. To illustrate this, I will in the following develop a model that is particularly useful for thinking about explanatory reasoning.

This model focuses on just three types of outcomes of pursuing a hypothesis H:

i. We get strong enough evidence in favour of H to accept it.
ii. We get strong enough evidence against H to reject it.
iii. We get inconclusive evidence, and so stay agnostic.

We can abbreviate each of these outcomes as $a(H)$, $r(H)$ and $\sim a(H)\&\sim r(H)$, respectively. So we are ignoring how to figure in the costs of pursuing H, whether pursuing H might reveal other interesting things about the world, as well the possible “effects upon other projects” or Franklin's pragmatic factors.

Let $EV(a(H))$, $EV(r(H))$ and $EV(\sim a(\mathrm{H}) \,\&\, \sim r(H))$ represent the *epistemic value* associated with each of the three outcomes obtaining. We can think of this as the degree to

which each of these outcomes would take us towards or away from reaching our epistemic goals. It corresponds roughly to what Peirce, McKaughan and Franklin call the "value" or "interest" of the hypothesis. Since pursuing *H* has a causal influence on which of outcome obtains, we should weigh each of these in terms of how probable they are to obtain *given* that we pursue it. Let $p(H)$ be the decision to pursue *H* and let $EEV(H)$ be the expected epistemic value of pursuing *H*, we thus have:[13]

$$
\begin{aligned}
(1) \qquad EEV(p(H)) = \quad & EV(a(H)) * Pr(a(H) \mid p(H)) \\
+ \quad & EV(r(H)) * Pr(r(H) \mid p(H)) \\
+ \quad & EV(\sim a(\mathrm{H}) \,\&\, \sim r(H)) * Pr(\sim a(H) \,\&\, \sim r(H) \mid p(\mathrm{H}))
\end{aligned}
$$

Since we are ignoring the costs and other effects of pursuing *H*, it is natural to stipulate for simplicity that the value of staying agnostic is nil, and so drop the last line.

Now, how epistemically valuable it would be to accept *H*, and how likely we are to get evidence for or against it, presumably depends on whether *H* is actually true. To make this explicit in the model, we can conditionalise on the truth and the falsity in each line, giving us:

$$
\begin{aligned}
(2) \qquad EEV(p(H)) = \quad & EV(a(H) \,\&\, H) * Pr(a(H) \mid H \,\&\, p(H)) * Pr(H) \\
+ \quad & EV(a(H) \,\&\, \sim H) * Pr(a(H) \mid \sim H \,\&\, p(H)) * Pr(\sim H) \\
+ \quad & EV(r(H) \,\&\, H) * Pr(r(H) \mid H \,\&\, p(H)) * Pr(H) \\
+ \quad & EV(r(H) \,\&\, \sim H) * Pr(r(\mathrm{H}) \mid \sim \mathrm{H} \,\&\, p(\mathrm{H})) * Pr(\sim \mathrm{H})
\end{aligned}
$$

13 The probabilities can be interpreted either as objective chances or credences, depending on whether one is interested in externalist or internalist justification for pursuit. In the latter case, the conditional probabilities should be interpreted as the credence that pursuing *H* will bring about the outcome.

In this model, then, we would be justified in pursuing that hypothesis H which maximises $EEV(p(H))$.[14]

One attractive feature of this model is that it explicitly represents a number of the factors mentioned earlier, and furthermore calls attention to some factors left out. I have already mentioned that $EV(a(H) \,\&\, H)$ and $EV(r(H) \,\&\, \sim H)$ represents how valuable or interesting it would be to know whether H is true. Correspondingly, $EV(a(H) \,\&\, \sim H)$ and $EV(r(H) \,\&\, H)$ is how problematic it would be to mistakenly accept a falsehood or reject a truth. The unconditional probabilities represent how likely or plausible H (and $\sim H$) is prior to testing; and the conditional probabilities represent how likely we are to get reliable and misleading evidence, respectively.

Models of this kind are of course both idealised and abstract. I do not suppose that it is generally possible to make anything but rough estimates or comparisons of these factors. Furthermore, the estimates of individual scientists, as well as what they take the most important epistemic outcomes of science to be, probably varies significantly. I do not have any comprehensive account of these matters. Finally, scientists obviously do not always conform to or even approximate this model in their deliberations about which hypotheses to pursue even when their goals are purely epistemic; nor do I claim that it would be better if they did. Nonetheless, I find that this kind of models provides a useful normative framework for expressing and clarifying issues regarding justification for pursuit. In the following I apply it to the case of explanatory reasoning.

4. How Explanatory Reasoning Justifies Pursuit

I claim that the Peircean view avoids Voltaire's Objection. In a nutshell, I claim that explanatory reasoning justifies pursuing a hypothesis H by showing that it would be more

14 The model becomes more complicated if we take into account possible synergy effects of pursuing more than one hypothesis simultaneously.

epistemically valuable to learn that *H* is true than its salient competitors.

To spell out this argument in more detail, notice first that the epistemic goals of science include more than simply knowing as many truths as possible. As Philip Kitcher (1993, 94) puts the point:

> Tacking truths together is something any hack can do. … The trouble is that most of the truths that can be acquired in these ways are boring. Nobody is interested in the minutiae of the shapes and colors of the objects in your vicinity, the temperature fluctuations in your microenvironment, the infinite number of disjunctions you can generate with your favorite true statement as one disjunct, or the probabilities of the events in the many chance setups you can contrive with objects in your vicinity. What we want is *significant* truth.

There are plenty of trivial truths out there that could be discovered and at much lower cost than the questions actually pursued by scientists. The value of scientific knowledge depends on other factors beyond merely the amount of truths known, no matter how certain.

Now, what these additional factors are – what other "epistemic goods", as we might call them, are important in science – is not something we need to give a general account of here. However, most philosophers of science, and explanationists in particular, seem to agree that having good explanations is among them.[15] So one way a hypothesis can be more epistemically valuable than merely being true is by being a good explanation, i.e. by increasing our understanding of the phenomena scientists investigate. Philosophers may

15 For instance, Kitcher (1993, 105ff) discusses "Explanatory Progress" as one of the goals pursued by science beyond mere truth.

disagree about why explanation and understanding are epistemically valuable – maybe they are intrinsically valuable, or maybe they are only valuable as a means to achieving other important epistemic goals. However, all I need for the present argument is that explanation/understanding is in fact epistemically valuable.

Now, consider the premise of an IBE: that the hypothesis *H* would provide the most understanding out of a set of rival explanations, if it were true. Thus, if we were to learn that *H* is actually true, this would be an epistemically valuable outcome. Indeed, learning that the most explanatory hypothesis is true would be the optimal epistemic outcome as far as explanation and understanding are concerned. Suppose, then, that everything else is held equal between a set of rival hypotheses: the costs of pursuing them are the same, we regard it as equally likely that pursuing them would give us reliable evidence for or against them, all other expected epistemic outcomes of pursuing them are equal, and so on. In this case, given the account of justification for pursuit outlined above, scientists would be justified in pursuing the most explanatory hypothesis (given that we focus on epistemic goals).

To express this in terms of the decision-theoretic model developed earlier, we can express the assumption that explanatoriness is *one* important epistemic goal as the claim that if H_1 is more explanatory than H_2, then, all else being equal, $EV(a(H_1)\ \&\ H_1) > EV(a(H_2)\ \&\ H_2)$.[16] Notice furthermore, from equation (2), if $EV(a(H_1)\ \&\ H_1) > EV(a(H_2)\ \&\ H_2)$ then, all else being equal, $EEV(p(H_1) > EEV(p(H_2)$. So it follows that if H_1 is more explanatory than H_2, we are, all else being equal, justified in pursuing H_1 rather than H_2.

The argument can be illustrated by an analogy: Suppose a team of treasure hunters know of two caves, C_1 and C_2, where a large treasure might be stashed. As far as they know the treasure is equally likely to be in either cave, but they only have the resources to send an expedition to one of them. However, they do know that C_1 could hold up to twice the

16 This is "all else being equal" since H_2 might be more valuable with regards to other epistemic goals besides explanatoriness.

amount of treasure that C_2 could. Assume that this does not give them any further information about its location or how difficult or expensive it would be to recover. Nonetheless, it is still more rational (for obvious decision theoretic reasons) for them to send the expedition to explore C_1 rather than C_2.

This argument shows that IBE can justify pursuit, all else being equal. In other words, explanatoriness can serve as a tie-breaker to justify pursuing one hypothesis rather than certain others. More generally, it should also be clear that if a hypothesis has a high degree of explanatoriness this adds to the expected epistemic value of pursuing it and thus gives *some* additional reason to pursue it, although not always a *decisive* reason.

Notice that I am assuming that we are deciding which hypothesis to pursue after we have fixed our estimates of all factors relevant to pursuit. If we, for instance, *discover* that a hypothesis is more unifying than we previously thought, or *change* it to become more unifying, this can influence our estimates of the other factors. So if revising the hypothesis makes it less plausible, this might cancel out any gains in explanatoriness. Similarly, we had to assume in the treasure hunter analogy that knowing the size of the cave does not provide additional information about the location of the treasure, or that they have already taken this into account.

Since nothing in this argument assumes a connection between explanatoriness and likeliness, this shows why the Peircean View avoids Voltaire's Objection. Let me close by considering a possible objection: Justifying the pursuit of a hypothesis still involves showing it to be minimally plausible or probable. Indeed, Peirce sometimes says that abductions give us "reason to suspect that [the hypothesis] is true" (CP 5.189) or reasons "regarded as lending the hypothesis some plausibility" (CP 2.511, footnote) and that "[c]ertain premises will render an hypothesis probable, so that there is such a thing as legitimate hypothetic inference [i.e. abduction]" (*loc. cit.*). However, if this is the case, the

Peircean view would also require *some* connection between explanatoriness and likeliness (or plausibility), even if a weaker one than explanationists tend to require. But this is sufficient for a version of Voltaire's Objection to apply to the Peircean view as well.

The premise of this objection is mistaken. Justification for pursuit need not stem from showing the hypothesis any more probable or plausible than before. Even if a necessary condition for a hypothesis being pursuitworthy is some minimal degree of plausibility, it is not sufficient. *One* way of justifying pursuit might be to show that the hypothesis is more plausible than previously thought. However, this is not the only way. For one thing, one could equally argue that a hypothesis is only worth investigating if it is not completely trivial or obvious.[17] Thus, could also justify pursuing a hypothesis by showing that there is more reason to doubt it than previously thought. And, as argued above, justification for pursuing a hypothesis can also stem from how interesting or valuable it would be to know whether it is true, independently of its plausibility.

Furthermore, it is not generally the case that having higher plausibility gives us more reason to pursue a hypothesis. Consider equation (2) again. If $Pr(H_1) > Pr(H_2)$ it does not follow that, all else being equal, $EEV(H_1) > EEV(H_2)$. First, raising $Pr(H_1)$ gives more weight to both the first and the third term in equation (1). So if, say, $EV(a(H_1), H_1) * Pr(a(H_1) \mid H \,\&\, p(H_1)) < EV(r(H_1) \,\&\, H_1) * Pr(r(H_1) \mid H_1, p(H_1))$ – which by assumption is the same for H_1 and H_2 – this make $EEV(H_1)$ *lower* than $EEV(H_2)$. Second, raising $Pr(H_1)$ at the same time lowers $Pr(\sim H_1)$, thus lowering the second and the third term. Again, depending on our estimates of the other factors, this could lower $EEV(H_1)$.

In sum, although being very likely or plausible can *sometimes* be a good reason to pursue a hypothesis, we can equally be justified in pursuing a hypothesis exactly *because*

17 In fact, neither of these conditions are necessary. As Franklin (1993a, ch. 3) points out, physicists sometimes pursue experimental work on a hypothesis after they regard it as conclusively falsified. Pursuing *H* can serve other epistemic goals beyond merely generating evidence for or against *H*.

we think it very likely false and it would be easy to show this. And this was in fact something Peirce often stressed:

> the best hypothesis … is the one which can be the most readily refuted if it is false. This far outweighs the trifling merit of being likely (CP 1.120)

This is also a plausible interpretation of why the physicists in Franklin's (1986) story chose to pursue the parity violation hypothesis, despite thinking it very likely to be false.

5. Conclusion

The argument given in this paper is quite general. It only rests on the premise that it, all else being equal, is more epistemically valuable to know whether more explanatory hypotheses are true than less explanatory ones. In particular, I have not presupposed any specific account of explanation or of why explanations are valuable. Combined with the account of justification for pursuit outlined in section 2, I have shown how this gives us a simple and straightforward connection between explanatoriness and justification for pursuit. The Peircean view avoids Voltaire's Objection and faces no analogous problems.

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