Low-Level IBE - Glymour and Hitchcock
Explanation and Realism, April 13th
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(I) *Van Fraasen's Challenge*

VF offers a positive anti-realist thesis and a dilemma for the realist who wants to use IBE to argue against constructive empiricism (henceforth CE).

VF+: VF has no rational *obligation* to believe that claims (about unobservables) in a scientific theory are true.

This is what the realist needs to argue against. The realist arguments we'll see go roughly like this:

(i) IBE is a cogent (though not deductively valid) argument form.
(ii) If one believes the premises of a cogent argument, and one believes that the argument is cogent, then one has a rational obligation to believe the conclusion of the argument.
(iii) VF believes the explanandum-premise of an IBE (i.e. Q)
(iv) And, for some hypothesis P_i which is about (or, probably better: made true by) unobservables, VF believes (or ought to believe) that 'P_i is the best explanation of Q among {P}' (i.e. the other premise of an IBE)

Hence VF+ is false.

VF- is directed against (iv).

VF-: For every realist hypothesis "H" there is a CE hypothesis, viz. ""H" is empirically adequate." The realist must admit these CE hypotheses into {P}, and also show that the realist hypotheses are better explanations, in order to establish (iv).

But last week we saw prima facie grounds for thinking that, in fact, CE hypotheses are better than realist hypotheses. In the case of observables, CE hypotheses are logically equivalent to their corresponding realist hypotheses. In the case of unobservables, CE hypotheses are equally likely and at least as probable as their corresponding realist hypotheses. So if probability and likelihood are the only measures of goodness of an explanation, then CE hypotheses will be at least as good at explaining as realist hypotheses.

But, of course, the realist may take up the challenge, and try to offer criteria on which realist explanations can compete with CE explanations and win. Glymour and $\text{Cartwright}_{\text{Hitchcock}}$ attempt to do this; Hitchcock argues against them.

Two points before we delve into Glymour and Hitchcock.

1. You might think that there's more hope for the realist at the low-level than at the high-

level. At the low-level, where the explananda are token physical events, the realist can milk our intuitions that (a) explanation of token physical events must be causal, and that (b) CE hypotheses are bad causal explanations ("CE hypotheses don't cite causes -- they cite realist hypotheses! So they're as poor as a causal explanation can get!" you might say. But is it really clear that they don't cite causes? Isn't the difference rather in the epistemic attitude they adopt towards the unobservable causes which both explanations do cite?). We'll come back to this at the end.

2. Is (ii) true? It seems pretty obviously false. For one thing, it's not clear that if I believe an instance of $P \rightarrow Q$ is a valid argument, and that P is true, then I have a rational *obligation* to believe Q. And if that's in doubt, then how much more dubious is it that an inference form which everyone admits isn't *deductively* valid (even if they use the term "valid" to describe it) should, if one believes it cogent and believes the premises of some instance, give one a rational *obligation* to believe its conclusion? It seems more likely that it gives one a *reason* to believe the conclusion; but, clearly, that's much weaker than an obligation. More generally an argument against VF+ will have to respect distinctions between:

a. S is rationally permitted to believe that P
b. S is rationally obliged to believe that P
c. S has a reason to believe that P
d. S has a warrant to believe that P
e. S has a mandate to believe that P

(II) *Glymour*

i. Glymour proposes an account of explanation and then gives (ceteris paribus) criteria for comparing explanations. He thinks this forces the anti-realist either to "disallow altogether explanatory criteria such as those [he] will describe" or to "arbitrarily (and vaguely) [restrict] the scope of application of such principles [i.e. explanatory criteria] to the realm of the observable." (p. 175) This is presumably because his criteria "yield the result that sometimes a theory with "nonobservation terms" has explanatory virtues that are unobtainable without such terms." (p. 176)

But this should be immediately fishy -- CE explanations do contain nonobservation terms! Perhaps he thinks that CE explanations mention rather than use them? But don't the CE hypotheses use them to get things right about observables?

Some problems particular to Glymour's strategy: (a) why think think that these criteria are correct? And (b) why think that ceteris are paribus in cases which involve unobservable entities -- doesn't his talk of Newton at the end of section IV show exactly that ceteris are not paribus in such cases? More generally, (c) how will we compare the "ceteris paribus" rankings of the different principles he offers, let alone all the different principles which would be required to capture our intuitions about the comparative goodness of explanations (if that's even possible)?

ii. On pp. 182-3, Glymour offers his own analysis of explanation.

"T explains H as a result of K" if either T, H, K or logically equivalent sentences satisfy:

(i) $T_i \vdash H_i \leftrightarrow K_i$
(ii) $T_{n+j} \vdash t_j = s_j$
(iii) $T_i \vdash H$ for any $i < n+k$
(iv) $K \vdash H(H_i\ t_j / K_i\ s_j)$ where $H(H_i\ t_j / K_i\ s_j) = H$ with all H_i and t_j replaced by K_i and s_j

Now, the motive for this was supposed to be that there are no analyses of explanation which allow us to say why a given explanation is better than others. But, if that's his motivation, then why introduce his own account which fails to do so? The comparative criteria he goes on to offer are almost entirely independent of which account of explanation is extended by adding them on. Is it really his aim of being descriptive of actual scientific practice which motivates this? Well, then he ought to show that the other accounts can't capture that! Moreover, why doesn't he consider a causal account?

iii. Some ceteris paribus criteria for comparing explanations

1. "*Ceteris Paribus*, if T and Q are theories and for every established pair of regularities, H, K, such that Q explains H as a result of K, T also explains H as a result of K, but there exist established regularities, L, J, such that T explains J as a result of L but Q does not explain J as the result of any other established regularity, [then] T is preferable to Q." (p. 186)

You might think that this just captures the intuition that, ceteris paribus, if T_1 explains all that T_2 does, and also explains more, then T_1 is a better explanation than T_2 is. But don't be fooled! Remember that L and J are well-established regularities; so this is the laws-only version of that intuitive principle. Presumably another criterion would have something to do with how many of the physical phenomena an explanation covers.

2. *Ceteris Paribus*, "explanations that explain regularities in terms of necessary truths" are better than "explanations that explain those same regularities in terms of other empirical generalizations." (p. 186) (i.e. if k is necessarily true, that's a good thing)

3. *Ceteris Paribus*, "explanations that explain regularities as the result of necessary truths and do so by means of connections that are themselves necessary" are better than those which do so by means of contingent connections. (p. 186) (e.g. if they claim that identities hold between 'quantities in the regularites.')

4. *Ceteris Paribus*, explanations which are not committed to the truths of claims about mysterious unobservable entities are better than those which do? (Glymour admits this at the bottom of p. 186 in the remark on Newton.)

iv. Do Glymour's criteria rank any realist hypotheses better than CE hypotheses?

I take it that II.i.a-c show that more would have to be done to make it plausible that even the criteria Glymour recognizes will rank realist hypotheses as better explanations than CE hypotheses. Rather, what we'll get *at best* will be conflicting rankings, in some of which the CE hypotheses will fare better and in others the realist hypotheses will fare better. Then what do we do with those conflicting rankings?

But do CE hypotheses come out worse even on (1), combined with Glymour's account of explanation? Suppose that T is any realist hypotheses which is about unobservables, and that S is the CE hypothesis "T" is empirically adequate. You might think that S would come out worse on Glymour's account because it has fewer deductive consequences (about observables). But, on account of Craig's theorem, we know that this is actually false:

> "Thus Craig's theorem … shows that for any theory T' using both theoretical terms and nontheoretical, previously understood ones [i.e. observational], there exists, under certain very widely satisfied conditions [satisfied, in particular, by the physical theories we're concerned with], an axiomatized theoretical system T'_B which uses only the nontheoretical terms of T' and yet is functionally equivalent with T' in the sense of effecting, among the sentences expressible in the nontheoretical vocabulary, exactly the same deductive connections as T'."[1]

v. It seems that Glymour missed the boat.

He concludes that "In each of the cases considered [in section II], the explanatory power is obtained by introducing theoretical connections and structure not explicit in the regularities to be explained, and in each of these cases the connections among empirical regularities could not be made at all without additional theoretical structure." (p. 187)

But (a) doesn't Craig's theorem also show that this is false? And even if the connections among empirical regularities aren't supposed to be deductive consequences (but then what?), so that Craig's theorem doesn't apply, (b) why think that the additional theoretical structure we end up with is the right one; that is, why think that the claims concerning the unobservables are true, as opposed to empirically adequate?

(III) *Hitchcock*

i. Hitchcock's central claim is that explanation and realism are orthogonal; the difference between realism and CE is solely in the epistemic attitude one adopts to scientific claims, including explanatory claims. So, even in the case of a causal explanation, the anti-realist "can treat this explanatory claim exactly as he did the earlier descriptive claim, interpreting it realistically [i.e. literally], but adopting an anti-realist epistemic attitude toward the claim. (p. 155)"

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[1] Quoted from Hempel, *The Theoretician's Dilemma*, pp. 212-3 of Aspects of Scientific Explanation and other Essays in the Philosophy of Science, Free Press, NY 1965

But, he says, Cartwright argues that "[causal] explanations secure belief in unobservable entities." That is, there is something about causal explanations which prevents adopting this epistemic attitude towards them.

Note that, strictly speaking, what she needs to show is that they secure belief in the truth of claims about unobservables - remember that this debate is about the truth of claims rather than the reference of the terms in those claims.

ii. Cartwright's account

Cartwright isn't as straightforward as Glymour; for instance, she doesn't think that IBE is always cogent; for instance, it isn't cogent for theoretical explanations (see section II) but only for causal explanations; that is, she claims that

(A) IBCE (Inference to the Best Causal Explanation) is cogent

This is motivated by appeal to an intuition pump: "my lemon tree is sick" is explained by "there is water in the base of the planter; wouldn't in fact we believe that there is water in the base of the planter?"

But this is not incompatible with VF+: "Sure," he could say, "that's what I would do in the case of water in the planter. For one thing, (a) it is observable, though as yet unobserved. But (b) even if it were actually unobservable, I'm not disputing that most people <u>do</u> believe realist hypotheses. I'm just disputing whether they have a rational <u>obligation</u> to do so - and in the context of the current debate, whether they have an obligation to do so <u>on the basis of an IBE-type inference</u>.

Moreover, Cartwright thinks that for E to be a causal explanation it must be true. That is,

(B) E is a causal explanation of B $\rightarrow$ E is true

And somehow this is supposed to guarantee that realist explanations come out as the best explanations.

But (B) doesn't rule out CE hypotheses at all! The CE-ist thinks that CE hypotheses are true.

At any rate, (B) is supposed to pull the weight of establishing that:

(C) Realist hypotheses about unobservables are better causal explanations than constructive empiricist hypotheses about unobservables.

And, if VF accepted (C), (as well as the demand that there are some explanations of observable phenomena which are causal explanations), then Cartwright would have established step (iv) of the argument in the 1st section of this handout, and thus would have answered VFs challenge (had step (ii) of that argument not been a pipe dream).

Sidenote: Is (C) true of quantum phenomena? If not, then what is left for the intuition which initially motivated the realist move to low-level IBE, that causal explanations are required of token physical phenomena? Well, clearly, we often find causal explanations of observable phenomena better than non-causal explanations -- but van Fraasen thinks that those explanations are true!

iii. Hitchcock's dilemma

Hitchcock proposes a dilemma for Cartwright. The realist claims that the inference from "P causally explains Q" and "Q" to "P" is warranted. But suppose II is true. Then either (a) we have independent grounds for believing that P or (b) we do not. If (a) we do have independent grounds, then "the purported causal explanation is idle" (p. 162), and all the justificatory work has been done withut mention of IBE; whereas if (b) we do not have independent grounds for thinking that P is true, then how is the realist going to justify the premise that "P best causally explains Q" is true (as opposed, remember, to P being empirically adequate)?

Another way to put this: if the realist maintains (B) and claims that their hypothesis is a causal explanation of some phenomenon, then they will have begged the question against the anti-realist.

iv. Cartwright chooses a horn

Apparently Cartwright thinks that "an inference to the most likely cause is only warranted if alternative explanations can be ruled out" (p. 164) That is, she opts for the first horn of the dilemma: we can have independent reasons for thinking that P is true. Hitchcock thinks this does not escape the dilemma, and that seems right.

v. Hitchcock's section IV

Hitchcock also argues that "reasons for accepting a causal explanation need not be reasons for believing it" (p. 175). I suppose that believing, here, means something like "accepting as true," and that he thinks the causal explanations of the uncertainty relations which he considers on pp. 167-172 are accepted but not accepted as true, but rather are accepted as pedagogically useful, or predictively useful, or empirically adequate, or something like that.

This seems entirely irrelevant. For one thing, why couldn't Cartwright respond that, in fact, such explanations are not *accepted - for the very reason that "the proffered explanations contradict almost every interpretation of quantum mechanics…"*

For another, surely the moral of Hitchcock's example is just that there are no good causal explanations of the uncertainty relations. Both the causal explanations on offer seem empirically inadequate. So either (a) there are better explanations than the causal explanations, or (b) there's no good explanation. In the former case, why think that the

best explanations will be realist rather than CE? In the latter, then presumably an IBE can't even give us good reason to believe in the causal explanation -- let alone a rational obligation.

Finally, the distinction between accepting-as-true and accepting simpliciter only matters (to VF+) if the claims not only <u>are</u> accepted by actual physicists, but <u>must</u> be. And why think that?