HEMPEL, SCHEFFLER, AND THE RAVENS *

HEMPEL has provided cogent reasons in support of the equivalence condition as a condition of adequacy for any definition of confirmation.† If confirmation theory is to be tied up with a theory of rationality, it would seem that the equivalence condition should be satisfied. For surely it would be odd to maintain that it is rational to believe a hypothesis S_1 on the basis of evidence E but not rational to believe S_2 on the basis of E even though S_1 and S_2 are logically equivalent. This is the point that Hempel seems to have in mind when he argues in defense of the equivalence condition that it would be strange to suppose

> . . . that it was sound scientific procedure to base a prediction on a given hypothesis if formulated in a sentence S_1, because a good deal of confirming evidence had been found for S_1; but that it was altogether inadmissible to base the prediction (say, for the convenience of deduction) on an equivalent formulation S_2, because no confirming evidence for S_2 was available (13/14).

Adoption of the equivalence condition, however, leads to the infamous raven paradox. Solutions to this paradox frequently have taken one of two forms. The first involves rejecting the equivalence condition in order to have a theory of confirmation that allegedly accords with our intuitions. The second involves keeping the equivalence condition but rejecting our intuitions by attempting to show that they are misguided. Scheffler takes the first approach **; Hempel the second (14–20).

Obviously, the plausibility of Scheffler's solution depends, in part, upon the strength of his arguments against the equivalence condition, whereas the plausibility of Hempel's account depends, in part, upon the cogency of his thesis that our intuitions are misguided. Neither approach seems to me satisfactory. For this reason, I wish to do several things in this paper. First I will show that Scheffler's argument against the equivalence condition is mistaken. Thus, in the absence of further argument, we are still in need of a theory of confirmation that satisfies the equivalence condition. Secondly, I will propose a solution to the raven paradox which (a)

* I am indebted to Jay Atlas and Robert Schwartz for their helpful criticisms of an earlier draft of this paper.

† Carl G. Hempel, "Studies in the Logic of Confirmation," *Mind*, LIV (1945), 213 (January): 1–26, and 214 (April): 97–121. Reprinted in Hempel's *Aspects of Scientific Explanation* (New York, 1965). Parenthetical page references to Hempel will be to this reprinted version. See pp. 13–14.

** Israel Scheffler, *The Anatomy of Inquiry* (New York: Knopf, 1963), pp. 286 ff. Parenthetical page references to Scheffler will be to this book.

satisfies the equivalence condition; (b) does not yield the unintuitive result that a white shoe confirms the hypothesis "All ravens are black"; and (c) accords with our intuitions in a crucial area where the theories of both Hempel and Scheffler fail us. The key to this solution depends upon acceptance of the view that logically equivalent hypotheses need not be equally projectible.

Scheffler appears to hold that evidence E confirms a hypothesis H if and only if H is projectible and E is a selectively positive instance of H. And E is a selectively positive instance of H if and only if E is both a positive instance of H (in Hempel's satisfaction sense of 'positive instance') and a negative instance of the contrary of H (in Hempel's satisfaction sense of 'negative instance'). Since logically equivalent hypotheses may have contraries that are not logically equivalent and since E may be a negative instance of the contrary of H but not a negative instance of the contrary of a logical equivalent of H, say H', E may confirm H but not H'.

This theory does not yield the paradoxical result that an object d which is a white shoe confirms the hypothesis "All ravens are black," since the sentence "d is not a raven and d is not black" is not a selectively positive instance of that hypothesis. But since this theory violates the intuitively plausible equivalence condition, Scheffler attempts to show that such a violation is not objectionable. In effect, Scheffler's argument is intended to show, *pace* Hempel, that it is sometimes reasonable to base a prediction on a given hypothesis formulated by a sentence S_1, but not reasonable to base the prediction on an equivalent formulation S_2. We now turn to Scheffler's argument.

Following Scheffler's numbering and with the obvious interpretation of the predicate letters, we list the following relevant sentences:

(1)	$(x)(Rx \supset Bx)$
(2)	$Ra \cdot Ba$
(3)	$\sim Bd \cdot \sim Rd$
(4)	$(x)(\sim Bx \supset \sim Rx)$
(6)	$(x)(Rx \supset \sim Bx)$
(7)	$(x)(\sim Bx \supset Rx)$

Scheffler's argument against the equivalence condition is as follows:

> . . . take (4) as our case of S_1, and imagine all the evidence to consist of statements such as (3). True, (3) satisfies (4) and also (1). But it also satisfies the contrary of (1), i.e., (6).
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> Do we have any reason, so far, for predicting that a new-found raven will be black rather than not? Since (1) and (6) together imply that

> there are no ravens, our new-found raven forces us to give up at least one of these statements. If we give up (6) and predict 'Black', we can retain (4). If we give up (1) and predict 'Not black', we have to give up (4) as well, for (4) and (6) are incompatible, given the existence of our raven. We might suppose we have here a reason for retaining (1) and predicting 'Black'. But, on the contrary, if we predict 'Black', thus saving (4), we shall need to give up another hypothesis hitherto confirmed, i.e., that nothing is black, whereas if we yield (4) and predict 'Not black', we can save the latter hypothesis. Here, it seems, is a case where basing a prediction directly on (4) (i.e., predicting 'Non-raven' for a new instance of 'non-black') is beyond suspicion, while basing a prediction directly on its equivalent, (1), is a matter of balanced decision. The reason, furthermore, is *not* that "no confirming evidence" (in the sense of satisfaction) is available for (1), but that whatever is available also supports its contrary, (6) (p. 290).

Surely, Scheffler is correct in claiming that, if our evidence consists solely of statements such as (3) *and if we are presented with a new evidence statement, say 'Rb'*, then it is a matter of balanced decision whether to employ (1) and predict that *b* is black or to employ (6) and predict that *b* is not black. On the basis of our evidence neither prediction is more reasonable than the other.[2] But this alone is not an argument against the equivalence condition, since it is also a matter of balanced decision whether to base the prediction on (4) which is logically equivalent to (1) rather than on (6). Conjoining our evidence statement with (4) will yield the prediction that *b* is black; conjoining it with (6) will yield the prediction that *b* is not black. In this situation, a prediction based on (4) is no more reasonable nor less a matter of balanced decision than a prediction based on its logical equivalent (1).

That Scheffler comes to a different conclusion stems from the fact that he switches examples in mid-argument. Initially, he tried to show that, given '*Rb*', a prediction made on the basis of (1) is a matter of balanced decision. He then tries to show that a prediction made on the basis of a logical equivalent of (1), namely (4), is beyond suspicion. *But in order to establish this latter point Scheffler suddenly changes the example.* Whereas the initial "balanced decision" prediction employing (1) was made on the assumption that

[2] For reasons which will soon become apparent, I believe that, on the basis of the stated evidence, neither prediction is reasonable. Unless otherwise noted, I assume throughout that the evidence statements referred to are the *sole* evidence statements at our disposal. Occasionally, for the sake of emphasis, this point is explicitly made in the text. And occasionally for the sake of convenience I speak of objects such as black ravens rather than of statements as the confirming evidence.

'Rb' was given, the new "beyond suspicion" prediction employing (4) is made not on the assumption that *'Rb'* is given, but rather on the assumption that, say, '$\sim Bc$' is given. Thus Scheffler writes, "predicting 'Non-raven' for a new instance of *'Non-black'* " (290; my italics).

But now we should ask whether, given '$\sim Bc$' (rather than given *'Rb'*), it is a matter of balanced decision to base the prediction 'Nonraven' on (1) but not on (4)? And the answer is obviously no. For by conjoining '$\sim Bc$' with (1) we derive '$\sim Rc$', and hence (1) as well as (4) yields the prediction 'Nonraven'. And there is no problem that the contrary of (1), namely (6), will yield a conflicting prediction when conjoined with our evidence statement. For, although (6) is confirmed, in Hempel's sense, by our evidence, (6) and '$\sim Bc$' do not yield 'Rc'. Further, since (7) is disconfirmed by our evidence, (7) cannot be appealed to in order to yield a prediction that conflicts with (1). So, given '$\sim Bc$', basing the prediction on (1) is just as much beyond suspicion as is basing the prediction on (4). And, given *'Rb'*, basing the prediction on (4) is just as much a matter of balanced decision as is basing the prediction on (1). Hence, Scheffler has not provided us with any grounds for rejecting the equivalence condition.

In the absence of convincing arguments against the equivalence condition, it is desirable to develop a theory of confirmation that satisfies it. Although Hempel's own theory does satisfy this condition, I find his solution to the raven paradox somewhat less than convincing. One of the reasons for this should now become apparent.

There are two key aspects of the raven paradox which have generally been neglected but which need to be accounted for in any satisfactory solution. First, most discussions of the raven paradox center around the question: Does (3) confirm (1)? How, for example, can a white shoe confirm the hypothesis "All ravens are black"? It is striking that neither Hempel nor Scheffler questions whether a white shoe confirms the hypothesis "All nonblack things are nonravens." Both assume that (3), in fact, does confirm (4). But it is just this questionable assumption that gives rise to the raven paradox. This assumption seems to me to be clearly wrong and the source of mistaken solutions to the raven paradox.

Second, although most discussions ask how it is possible for (3) to confirm (1), they do not ask how it is possible for a black raven to confirm the hypothesis "All nonblack things are nonravens." That (2) confirms (4) does not seem paradoxical at all. Yet, if the approach taken by Hempel or Scheffler were correct, then the claim that (2) confirms (4) should seem as paradoxical as the claim that (3) confirms (1). But clearly it is not. That *a* is a raven and *a* is black does seem to confirm (4) ("All nonblack things are nonravens"). But that *d* is not a raven and *d* is not black does not seem to confirm (1) ("All ravens are black"). Recognition of this asymmetry in our confirmation intuitions is crucial for a satisfactory solution to the raven paradox. Yet, neither Hempel nor Scheffler recognizes or accounts for it. How, then, can it be accounted for?

The answer, I believe, is this: Hypothesis (1) is projectible, whereas (4) is not.[3] The selectively positive instances of (1) in general increase the credibility of statements asserting that other ravens are black and, hence, confirm (1), whereas the selectively positive instances of (4) do not in general increase the credibility of statements asserting that other nonblack things are nonravens and, hence, do not confirm (4). In the absence of any negative instances of (4), the initial grounds for classifying it as unprojectible are essentially the same as the grounds for classifying "All emeralds are grue" as unprojectible or "All emerubies are gred" as unprojectible[4]; namely, that their respective selectively positive instances do not in general increase their credibility.[5] Finding a nonblack

[3] I follow Goodman's terminology. See *Fact, Fiction, and Forecast,* 2nd ed. (Indianapolis: Bobbs-Merrill, 1965), ch. IV. Hereafter FFF. I recently learned that Quine has proposed a sketchier but, in part, somewhat similar solution. See his "Natural Kinds," in *Ontological Relativity and Other Essays* (New York: Columbia, 1969).

[4] Something is grue if and only if it is green and examined before *t* or not so examined and is blue; something is an emeruby if and only if it is an emerald and examined before *t*, or is not so examined and is a ruby; something is gred if and only if it is green and examined before *t*, or not so examined and is red.

[5] On this point see, for example, FFF, pp. 69, 73, and 77, and Goodman, "Two Replies," this JOURNAL, LXIV, 1967, p. 286. Of course, if our evidence consists solely of nonblack nonravens, then (4) is not eliminated by Goodman's projectibility rules as set forth in FFF; for there is no supported, unviolated, unexhausted, and significantly better entrenched hypothesis that conflicts with (4). In the absence of such a conflict, our grounds for classifying (4) as unprojectible might be the low entrenchment of its antecedent and consequent predicates. In FFF, p. 106, Goodman himself claims that there may be hypotheses which escape elimination by his rules, but which are nevertheless not projectible. (4), I believe, is such a hypothesis.

In "An Improvement in the Theory of Projectibility" by Robert Schwartz, Israel Scheffler, and Nelson Goodman, this JOURNAL, LXVII, 18 (Sept. 17, 1970): 605–608, some changes are made in Goodman's theory as proposed in FFF. Now there is a threefold classification of hypotheses—projectible, unprojectible, and nonprojectible. I believe that, under the conditions stated above, (4) will turn out to be nonprojectible according to this revised theory. Suppose our evidence consists solely of white shoes, red herrings, etc., examined before time *t*; i.e., all and only nonblack nonravens. Let us introduce a new predicate 'braven' nonraven does not in general increase our belief that all other nonblack things are nonravens. Hence, (3) does not confirm (4) and *a fortiori* (3) does not confirm (1). Both Hempel and Scheffler, then, are mistaken in affirming the confirmation of (4) by (3). Further, finding a black raven surely increases our belief that all other ravens are black and also our belief that all nonblack things are nonravens. And this accounts for its being nonparadoxical to suppose that (2) confirms (4). Hence the projectibility of (1) and the nonprojectibility of (4) account for the earlier mentioned asymmetry in our confirmation intuitions.

The above argument assumes that logically equivalent hypotheses such as (1) and (4) need not be equally projectible. This view, I believe, is correct, and it is compatible with Goodman's position in *Fact, Fiction, and Forecast*. For the projectibility value of a conditional hypothesis depends upon the entrenchment value of its antecedent and consequent predicates. But since the antecedent and consequent predicates of (1) differ from and are not coextensive with those of (4), it follows that under Goodman's theory (1) and (4) need not be equally projectible.[6] And it would appear that the unprojectability of (4) is due to the poor entrenchment of its antecedent and consequent predicates.

If my previous remarks are correct, then both Hempel and Scheffler have been mistaken in their proposed solutions to the raven paradox. Both assumed that, given (3) as the sole evidence, it confirmed (4). Hempel then tried to explain why our intuitions are misguided in our supposing that (3) does not confirm (1). Scheffler, on the other hand, supposed that, in an important and strong sense of confirmation, (3) confirmed (4) but not (1). He then

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that applies to all objects examined before t just in case they are nonravens and to other things just in case they are ravens. Under the stated conditions both (4) and

(8) All nonblack things are bravens.

are supported, unviolated, and (presumably) unexhausted. But (4) and (8) conflict. Can (8) be eliminated because of a conflict with (4)? This can be done only if 'nonraven' as a consequent predicate is appreciably better entrenched than 'braven'. But is it? It seems unlikely that 'nonraven' is "a veteran of earlier and many more projections" than 'braven'. If this is true, then neither (4) nor (8) is overriden, and, under the revised theory, both (4) and (8) would be classified as nonprojectible. Hence, neither would be confirmed by its instances.

[6] See FFF, pp. 101–102, n. 13. Elsewhere Goodman remarks that "many consequences of projectible hypotheses are not themselves projectible" ("Comments," this JOURNAL, LXIII, 11 (May 26, 1966): 328–331, p. 328. Cf. FFF, p. 108, n. 16). A necessary condition for a hypothesis to be projectible is that it be supported. If our evidence consists solely of black ravens then, according to Goodman's theory, (1) but not (4) would be projectible, since (4) is unsupported.

proposed a theory of confirmation which yielded this result. What I have suggested, however, is that the initial mistake of both Hempel and Scheffler was in supposing that under the stated conditions (3) confirmed (4).

Once we rid ourselves of the belief that (3) confirms (4), we avoid the major problem with the equivalence condition. For if we grant that (3) does not confirm (4), we are not forced to reject the equivalence condition in denying that (3) confirms (1). Furthermore, since neither (4) nor (1) is confirmed by (3), neither a prediction based on (4) nor a prediction based on (1) will be reasonable. On the other hand, it is obvious that, given (2) as the sole evidence, it confirms (1); (1) is projectible, and (2) is a selectively positive instance of (1). But if we grant this and if we also accept the equivalence condition, then we are committeed to the view that (2) confirms (4). But, as stated earlier, this view seems perfectly legitimate. At least according to my confirmation intuitions, it seems clear that finding a black raven does increase the credibility of the hypothesis that all nonblack things are nonravens.

We are now led to the following position: although (4) is not projectible in the sense that in general *its* selectively positive instances do not increase its credibility [and hence, (4) is not confirmed by its selectively positive instances], (4) is, nevertheless, confirmed by the selectively positive instances of a logically equivalent hypothesis, namely, (1). Thus, a hypothesis that is not projectible still is confirmed by the selectively positive instances of a logically equivalent hypothesis, provided that such instances confirm the hypothesis of which they are selectively positive instances.[7] The equivalence condition is thereby satisfied; for, according to this notion of confirmation, if evidence E confirms a hypothesis H, then E confirms all logical equivalents of H. So, if we restrict ourselves to simple universal conditionals to which both Scheffler's notion of

[7] The view that a given piece of evidence may confirm a hypothesis even though it is not a selectively positive instance of that hypothesis is not in conflict with Goodman's remarks in FFF. On pp. 74–75 Goodman notes that the prediction that all *subsequently* examined emeralds will be green is confirmed by the evidence statement that a given emerald is green. This evidence statement, however, is not an instance of the confirmed prediction. Rather it is an instance of a hypothesis of which the prediction is a consequence. And obviously the prediction itself, since unsupported, is not projectible. An interesting side issue is raised by Goodman's remark, since it assumes the validity of the consequence condition. But since the consequence condition entails the equivalence condition, the rejection of the latter condition requires the abandonment of the former. Goodman, then, would encounter problems if he were (as is sometimes suggested) to give up the equivalence condition.

selectively positive instance and Goodman's theory of projectibility apply, we may propose the following definition of direct confirmation by such instances:

Evidence E directly confirms a hypothesis $H =_{\mathrm{df}}$ H is projectible and E is a selectively positive instance of H, or E is a selectively positive instance of a projectible hypothesis H' that is logically equivalent to H.[8]

This view of confirmation appears to be plausible. It accords with our confirmation intuitions and yet preserves the equivalence condition.

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[8] Following Hempel, we can then define "E confirms H" as "H is entailed by a class of sentences each of which is directly confirmed by E." For reasons which I have given elsewhere [see my "Inductive and Ethical Validity," *American Philosophical Quarterly*, VIII, 1 (January 1971): 35–44], I believe that the notion of confirmation by selectively positive instances provides sufficient but not necessary conditions for one statement to confirm another. The previous definitions, then, can be more accurately construed as defining the narrower notions of "selectively positive-instance direct confirmation" and "selectively positive-instance confirmation."