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The Paradoxes of Confirmation by H. G. Alexander; Corroboration Versus Induction by J. Agassi; The Paradoxes of Confirmation--A Reply to Dr. Agassi by H. G. Alexander; Confirmation without Background Knowledge by J. W. N. Watkins  
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which consists of *E* in conjunction with an additional amount of information which we happen to have at our disposal.”

In his rejoinder Scheffler reiterates.

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H. G. ALEXANDER. *The paradoxes of confirmation*. *The British journal for the philosophy of science*, vol. 9 (1958–9), pp. 227–233.

J. AGASSI. *Corroboration versus induction*. *Ibid.*, pp. 311–317.

H. G. ALEXANDER. *The paradoxes of confirmation—a reply to Dr. Agassi*. *Ibid.*, vol. 10 (1959–60), pp. 229–234.

J. W. N. WATKINS. *Confirmation without background knowledge*. *Ibid.*, pp. 318–320.

Continuing the discussion between Hempel and Watkins, reviewed above, Alexander first claims that Watkins's insistence that a hypothesis can be supported only by the result of a test does not succeed in dissolving Hempel's paradox, since “The presupposition of Hempel's discussion is that we must consider only the hypothesis and not introduce tacit reference to any of our existing knowledge about ravens, black objects, etc. If we accept this limitation then there in general seems no reason why the finding of black shoes (there *might* have been a non-black raven in the closet) or of white swans (there *might* have been some non-black ravens in the swannery) should not count as unsuccessful attempts to falsify . . . ‘All ravens are black’.” Alexander then attempts to analyze the paradox by showing that the intuitions leading to it can be explained in terms of background knowledge about the relative frequency of ravens and black things in the universe. He argues that given this background knowledge, reports of black ravens (the “relevant instances” of the paradox) will provide *more* support for the hypothesis than will reports of either black non-ravens or non-black non-ravens (the “irrelevant instances” of the paradox) if and only if the relative frequency of ravens is less than that of non-black objects. To complete the analysis, the author claims that for hypotheses of the form “All  $\phi$ 's are  $\psi$ ” where  $\phi$  and  $\psi$  are expressed by simple predicate phrases in ordinary language, his assumption that the frequency of  $\phi$ 's is less than that of non- $\psi$ 's almost always holds.

Two arguments are provided to establish the relative degrees of support of the hypothesis by different instances in the light of this background knowledge. The first is that a confirming result of the experimental test, (e1) check an object known to be a raven for color, will increase the confirmation of the hypothesis more than a confirming result of the experimental test, (e2) check an object known not to be black for species. For solely on the basis of the background knowledge, and in the absence of the hypothesis, the first is less likely. This argument was first proposed in Hosiasson-Lindenbaum's VI 63. The present author is less clear than Hosiasson-Lindenbaum as to the suppressed assumption connecting this result with Hempel's paradox, namely that the observation reports of a black raven and a non-black non-raven, are here thought of as having resulted from tests of the kind indicated. Note however that if the report of a black raven resulted from the experimental test, (e3) check an arbitrary object for color and species, or the experimental non-test, (e4) check an object known to be black for species, then this report would (on certain natural definitions) be *less* confirming than that arising from (e2).

The author's reasoning in the case of the second argument is more explicit. Here, he proposes to measure the support of a hypothesis *H* by an observation report *R*, by comparing the inverse probabilities of the report with and without the hypothesis ( $P(R, H \& K)$ ,  $P(R, K)$  where *K* is the background knowledge). The exact measure chosen is the ratio  $\frac{P(R, H \& K)}{P(R, K)}$  (first proposed

by Keynes), which leads to the desired result. The reviewer notes that a closely related and equally plausible measure is the difference  $P(R, H \& K) - P(R, K)$ , and that in terms of this measure, reports of black ravens and non-black non-ravens offer exactly equal support. The second argument can be considered as a proposal to measure the support offered by different results from (e3). The author seems to be unaware of the fact that his proposal undermines the positions of both Hempel and Watkins. It undermines Hempel's position because a report of a black non-raven resulting from (e3) would *weaken* rather than support the hypothesis, and it undermines Watkins's position because, if extended to take account of (e1), (e2), and (e4) (by adding to *K* the initial conditions of the experiment), a report of a black raven resulting from even so obvious a non-test as (e4) would *support* rather than be irrelevant to the hypothesis.

In that part of Agassi's discussion note which is most relevant to this JOURNAL, he characterizes Alexander's two suggestions for determining the relative support of a hypothesis by evidence as follows: "The first is that the better the evidence the more improbable it must be. The second is that the evidence has to be improbable not given that the hypothesis is true, and probable given that the hypothesis is true . . ." Agassi claims that both are necessary, although not sufficient, and that they follow from a suggestion in Popper's XX 304.

In reply, Alexander rejects Agassi's loose formulation of his first suggestion. He then discusses Popper's proposal with a view to showing that, contrary to Agassi's remark, on Popper's proposal the background knowledge that the relative frequency of ravens is greater than that of non-black objects, is sufficient for a report of a black raven to support the hypothesis better than a report of a non-black non-raven. The reviewer agrees that Popper's proposal has this result, but Alexander's argument is not convincing since he (1) confuses the *relative* probability of a known raven being black with the *absolute* probability of an arbitrary object being a black raven, and (2) uses Popper's formula for the case where no background knowledge is assumed, although Popper also gives a formula for the case where background knowledge is involved.

Watkins responds to Alexander's claim that if prior background knowledge is excluded, the finding of black shoes, etc., should count as an unsuccessful attempt to falsify the hypothesis, with the remark that if "*c* is known to be no raven; *d* is known to be black . . . Then, without any background beliefs about the relative probabilities of an object being a raven and being non-black, . . . I know that further investigation of *c* and *d* could not possibly lead to its falsification and hence that the results of such an investigation, whatever they might be, could not confirm [the hypothesis] according to a testability-theory of confirmation. But on an instantiation-theory, both *c* and *d* (which might be an elephant and a dinner-jacket respectively) instantiate, and therefore 'confirm,' our hypothesis." But here, as in his reply to Scheffler, Watkins has not correctly understood that in the situations described the prior knowledge about *c* and *d* must be counted as part of the background knowledge, or formally accounted for in some similar way. Part of the difficulty on this point clearly results from treating Hempel's problem as Hempel initially formulates it: which of various objects (black ravens, black shoes, etc.) confirm the hypothesis. Hempel later rejects this formulation in favor of: which of various observation reports (of an object being black, of its being a black raven, etc.) support the hypothesis. It is not hard to see how Hempel's theory could be extended to define *the observation report*  $O_1$  confirms the hypothesis *H* in the light of the prior observation report  $O_2$ , or to see that according to such an extension "Edgar is a raven" would not confirm "All ravens are black" in the light of the prior knowledge "Edgar is black." The reviewer believes that if Hempel's theory were so modified as to be able to express the situations in which Watkins and Agassi are interested, it would yield results not unlike those they espouse.

On a final point of reconciliation, it is noted that Popper's formal definition of confirmation, referred to by Agassi and Alexander (and also a simpler version given in Popper's XXV 383) is in accord with Alexander's second suggestion in the respect, mentioned above, that the hypothesis can be supported by a result of the apparent non-test ( $\epsilon_4$ ). Thus it appears that in their requirement that a *test* provide a possible conclusive refutation of the hypothesis (and this requirement seems to lie at the base of the present controversy) Watkins and Agassi may have misrepresented Popper.

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R. H. VINCENT. *The paradoxes of confirmation*. *Mind*, n.s. vol. 73 (1964), pp. 273-279.

In criticism of Watkins's replies to Scheffler and Alexander, reviewed above, the author argues that the reports "Edgar is a black raven," "Edgar is a black non-raven," and "Edgar is a non-black non-raven" *always* result, in part, from a test of the hypothesis "All ravens are black," and therefore Watkins's testability criterion of confirmation does not avoid the paradox of confirmation. To Watkins's case of the known non-raven examined for color, the author demurs that the prior knowledge "Edgar is a non-raven" always results from a test of the hypothesis. But since this information can be obtained by testing only for species, and ignoring color, the reviewer does not agree that it must result from a test of the hypothesis. Further, to conflate in this way the prior and posterior information involved in Watkins's case is to confound Carnap's notion of confirmation—roughly, the probability of a hypothesis in the light of