The Reverend and the Ravens: Comment on Seawright

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1 Introduction

The purpose of this Comment is to put the current debate regarding testing necessary conditions into perspective and to point out a particularly troubling aspect of the "all cases" research design (Seawright 2002).

Prior to the recent spate of books and articles in the social sciences (Ragin 1987; Dion 1988; Braumoeller and Goertz 2000), the debate over the testing or the confirmation of necessary conditions took place in the philosophical literature, mainly in terms of Hempel's (1945) paradox of the ravens. In what follows, I briefly review Hempel's paradox and the Bayesian solution to it. I argue that Seawright's account, while Bayesian in nature, relies on an assumption that no Bayesian would be willing to make.

2 Necessary Conditions and the Ravens Paradox

The statement that peasant village autonomy is a necessary condition for social revolution is logically equivalent to the statement that being black is a necessary condition for being a raven.[1] Hempel's paradox is therefore directly relevant and the "black raven" notation provides a convenient shorthand.

The paradox is easily explained. Begin with the necessary condition that "all ravens are black," or

$$(\forall x)(Rx \rightarrow Bx). \tag{1}$$

Equation (1) is logically equivalent to the statement that "whatever is not black is not a raven," or

$$(\forall x)(\neg Bx \rightarrow \neg Rx). \tag{2}$$

The evidence of a black raven (Ra and Ba) confirms Eq. (1) and the evidence of a nonblack, nonraven ($\neg Rb$ and $\neg Bb$) confirms Eq. (2).

[1]The argument that these claims are not equivalent because the former is "causal" and the latter is not is false, as the argument rests on a notion of "cause" that few philosophers are willing to accept (see Humphreys 1989). "Condition" is the more accurate term.

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Hempel's paradox lies in the fact that because Eqs. (1) and (2) are logically equivalent, the evidence of a nonblack, nonraven ($\neg Rb$ and $\neg Bb$) confirms the claim that "all ravens are black." The lazy investigator, therefore, need only observe the white paper, yellow pencils, and blue books in his office to confirm that being black is a necessary condition for being a raven. Intuition tells us that this claim must be false. Philosophers have spent the last 57 years attempting to figure out why (Ra and Ba) is evidence that "all ravens are black" and ($\neg Rb$ and $\neg Bb$) is not.

The paradox is particularly relevant if we consider the Skocpol case. Seawright (2002) shows that the posterior probability of the necessary condition hypothesis increases from .8 to .9 by considering three additional cases characterized by neither village autonomy nor social revolution. Making use of these additional cases is equivalent to observing "yellow pencils" in the hope of demonstrating that "all ravens are black." Seawright's paper comes down to the claim that the use of these cases is legitimate. The argument is predicated on the Bayesian account of the paradox.

3 The Bayesian Account

The Bayesian account of the paradox of the ravens is given in an early form by Mackie (1963) and in a modern formulation by Howson and Urbach (1993).[2] The essence of the Bayesian account concerns the *degree* to which ($\neg Rb$ and $\neg Bb$) confirms the hypothesis. Because the proportion of things that are nonblack is far larger than the proportion of things that are ravens, ($\neg Rb$ and $\neg Bb$) confirms that "all ravens are black," but only to a negligible degree. That is, the evidence updates the posterior probability of the hypothesis, but only by a minuscule amount. As the proportion of things that are ravens is much smaller than the proportion of things that are nonblack, (Ra and Ba) provides nonnegligible confirmation of "all ravens are black." That is, the evidence updates the posterior probability of the hypothesis by a significant amount.

4 The All Cases Design

The Bayesian account is far from being universally accepted and the paradox of the ravens remains one of the most controversial subjects in the philosophy of science (Earman 1992, p. 240). What I would like to point out is that even if we accept the Bayesian account, the "All Cases Design" rests on a quite dubious assumption.

Unlike the normal Bayesian account, Seawright makes the claim that not only does ($\neg Rb$ and $\neg Bb$) confirm that "all ravens are black," but it confirms the hypothesis to the *exact degree* as (Ra and Ba).[3] We can see this by considering Fig. 1 (a version of Seawright's Fig. 2b) and the equation

$$\Pr(WH \mid D) = \frac{\Pr(WH)}{\Pr(WH) + \Pr(AH)[1/(a + c + d + 3)]}. \tag{3}$$

Note that regardless of whether new observations fall in Cell a, Cell c, or Cell d, the effect on the posterior probability is exactly the same. Therefore, observing ($\neg Rb$ and $\neg Bb$) is every bit as good, as evidence, as observing (Ra and Ba).

[2] Due to space considerations, I only sketch the solution here.

[3] Seawright's use of "well-bounded population[s]" as a defense is similar to Lawson (1985) and is ably dispensed with by French (1988). Even if we restrict the population to birds, we still believe that a green parrot does not confirm that "all ravens are black" to the same degree that a black raven does.

	Black	$\sim$ Black
Raven	a	b
$\sim$ Raven	c	d

Fig. 1 Potentially relevant cases.

It is possible, using Bayes's theorem, to describe the condition under which this result holds. To do so, I make use of results given by Earman (1992) in a reanalysis of work by Horwich (1982).

Let K, the background knowledge, contain the information that a was drawn from the class of ravens (as would occur under the positive on outcome design) and b was drawn from the class of nonblack objects (permissible under the All Cases Design). The question is under what condition ($\neg Rb$ and $\neg Bb$) provides as much evidence as (Ra and Ba) or

$$\Pr(H \mid Ra \,\&\, Ba \,\&\, K) = \Pr(H \mid \neg Rb \,\&\, \neg Bb \,\&\, K). \tag{4}$$

Applying Bayes's theorem to both sides of Eq. (4), we find[4]

$$\frac{\Pr(H \mid K)}{\Pr(Ba \mid K)} = \frac{\Pr(H \mid K)}{\Pr(\neg Rb \mid K)}. \tag{5}$$

Seawright's claim holds, then, when $\Pr(Ba \mid K) = \Pr(\neg Rb \mid K)$. This equality, in turn, holds when[5]

$$\Pr(\neg Ba \mid \neg H \,\&\, K) = \Pr(Rb \mid \neg H \,\&\, K). \tag{6}$$

Equation (6) states that given that some ravens are nonblack ($\neg H$), we are just as likely to get a nonblack raven by selecting from the class of ravens as we are by selecting from the class of nonblack things. *Therefore, the class of ravens must be the same size as the class of nonblack things.* This condition surely does not hold in our world.

To return to Seawright's substantive example, a case of no village autonomy and no revolution can provide as much evidence as a case of village autonomy and revolution only if the population of cases of revolutions equals the population of cases of no village autonomy. This condition is highly unlikely to hold even in a bounded universe of cases.

5 Conclusion

Thinking in terms of Hempel's paradox of the ravens provides useful insights regarding the testing of necessary conditions. Seawright makes the claim that cases where both the outcome and the necessary condition are absent are just as informative as cases where both the outcome and the necessary condition are present. The analysis performed above

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$$\Pr(H \mid Ra \,\&\, Ba \,\&\, K) = \frac{\Pr(Ra \,\&\, Ba \mid H \,\&\, K)\Pr(H \mid K)}{\Pr(Ra \mid Ba \,\&\, K)\Pr(Ba \mid K)} = \frac{\Pr(H \mid K)}{\Pr(Ba \mid K)}.$$

5 This move comes from applying the principle of total probability to $\Pr(Ra \mid Ba \,\&\, K)\Pr(Ba \mid K)$. See Earman (1992, p. 72).

demonstrates that this claim holds only under a very restrictive assumption—the population of cases where the outcome is present must be the same as the population of cases where the necessary condition is absent. Although Seawright's account is couched in Bayesian terms, no Bayesian would accept the above condition. The "All Cases Design" does not pose a serious threat to the "positive on outcome" design.

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