

On the Equivalence of Goodman's and Hempel's Paradoxes

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DRAFT

Nevertheless, the difficulty is often slighted because on the surface there seem to be easy ways of dealing with it. Sometimes, for example, the problem is thought to be much like the paradox of the ravens (Nelson Goodman, *Fact, Fiction and Forecast*, p. 75)

Abstract: Historically, Nelson Goodman's paradox involving the predicates 'grue' and 'bleen' has been taken to furnish a serious blow to Carl Hempel's theory of confirmation in particular and to purely formal theories of confirmation in general. In this paper, I argue that Goodman's paradox is no more serious of a threat to Hempel's theory of confirmation than is Hempel's own paradox of the ravens. I proceed by developing a suggestion from R.D. Rosenkrantz into an argument for the conclusion that these paradoxes are, in fact, equivalent. My argument, if successful, is of both historical and philosophical interest. Goodman himself maintained that Hempel's theory of confirmation was capable of handling the paradox of the ravens. And Hempel eventually conceded that Goodman's paradox showed that there could be no adequate, purely syntactical theory of confirmation. The conclusion of my argument entails, by contrast, that Hempel's theory of confirmation is incapable of handling Goodman's paradox if and only if it is incapable of handling the paradox of the ravens. It also entails that for any adequate solution to one of these paradoxes, there is a corresponding and equally adequate solution to the other.

Historically, Nelson Goodman's paradox involving the predicates 'grue' and 'bleen' has been taken to furnish a serious blow to Carl Hempel's theory of confirmation in particular and to purely formal theories of confirmation in general. In this paper, I argue that Goodman's paradox is no more serious of a threat to Hempel's theory of confirmation than is Hempel's own paradox of the ravens. I proceed by developing a suggestion from R.D. Rosenkrantz into an argument for the conclusion that these paradoxes are, in fact, equivalent.

If the conclusion of my argument is correct, it is of both historical and philosophical interest. Goodman himself maintained that Hempel's theory of

confirmation was capable of handling the paradox of the ravens.¹ And Hempel eventually conceded that Goodman's paradox showed that there could be no adequate, purely syntactical theory of confirmation.² The conclusion of my argument entails, by contrast, that Hempel's theory of confirmation is incapable of handling Goodman's paradox if and only if it is incapable of handling the paradox of the ravens. It also entails that for any adequate solution to one of these paradoxes, there is a corresponding and equally adequate solution to the other. At the end of the paper, I test this latter entailment against three historically prominent proposed solutions to Hempel's paradox (one proposed by Quine, one proposed Israel Scheffler, and against Hempel's own proposed solution). I argue that, in each of these cases, the proposed solution to Hempel's paradox succeeds if and only if a corresponding solution to Goodman's paradox does.

Background

It will prove useful for what follows to bring into the foreground some of the historical details surrounding Hempel's theory of confirmation and the discussion of the paradoxes of confirmation that arose in connection with it. While much of this will involve revisiting old ground, my hope is to highlight those aspects of the historical discussion that are most relevant to the central argument of this paper.

In his "Studies in the Logic of Confirmation," Hempel sets out to provide a formal theory of inductive confirmation, comparable to formal theories of valid deduction.³ He begins his discussion by criticizing previous attempts to produce formal criteria of confirmation. In particular, he criticizes a condition of confirmation set

¹ See (Goodman 1983, 70-72, 75).

² (Hempel 1965, 50-51)

³ (Hempel 1945a, 2-3)

forward by Jean Nicod. Nicod's condition can be intuitively stated as the condition that universal generalizations are confirmed by their positive instances and disconfirmed by their counterexamples.

A bit more formally, and in Hempel's own words, Nicod's condition states that a hypotheses of the form

$(x)(P(x) \supset Q(x))$... is confirmed by an object a if a is P and Q ; and the hypothesis is disconfirmed by a if a is P , but not Q . In other words, an object confirms a universal conditional hypothesis if and only if it satisfies both the antecedent ... and the consequent ... of the conditional; and ... it is neutral, or irrelevant, with respect to the hypothesis if it does not satisfy the antecedent.⁴

Hempel criticizes Nicod's condition on two grounds. First, Hempel notes that "the applicability of this criterion is restricted to hypotheses of universal conditional form," but what we want, according to Hempel, is "a criterion of confirmation which is applicable to hypotheses of any form."⁵ Second, Hempel notes that if Nicod's condition is taken as a necessary and sufficient condition for confirmation, it conflicts with another highly intuitive condition of confirmation, one that Hempel refers to as "the equivalence condition." According to the equivalence condition, whatever confirms a hypothesis also confirms whatever statements are logically equivalent to that hypothesis.⁶ Now, as Hempel points out, the statement *All ravens are black* is equivalent to the statement *Whatever is not black is not a raven*. But, as Hempel observes, Nicod's condition, taken as a necessary condition for confirmation, entails, for example, that an object that is black and a raven would confirm the former generalization but not the latter.⁷

Although Hempel eschews Nicod's condition as a *necessary* condition for confirmation, however, he does concede that Nicod's condition might plausibly be

⁴ (Hempel 1945a, 10)

⁵ (Hempel 1945a, 10-11)

⁶ (Hempel 1945a, 12)

⁷ (Hempel 1945a, 11)

construed as a *sufficient* condition for confirmation.⁸ But so taken, Hempel points out, Nicod's criterion, in combination with the equivalence condition, generates a paradox. As noted above, the statement *All ravens are black* is equivalent to the statement *Whatever is not black is not a raven*. Now, given Nicod's condition, the latter statement is confirmed by anything that is both non-black and a non-raven. And, by the equivalence condition, whatever confirms the latter of the above statements confirms the former of them. From this it follows, as Hempel put it, that "any red pencil, any green leaf, and yellow cow, etc., becomes confirming evidence for the hypothesis that all ravens are black."⁹ But it seems wrong that we could learn about the color of ravens without ever observing a single raven! As Goodman puts the matter, "the prospect of being able to investigate ornithological theories without going out in the rain is so attractive that we know there must be a catch in it."¹⁰

It is important for Hempel that he offer some solution to the paradox of the ravens, since the theory of confirmation that he himself ends up developing also generates that paradox.¹¹ The specific details of Hempel's own theory need not concern us, except in two respects (the relevance of which will become apparent later on).

First, Hempel takes the relation of confirmation to be statements (sentences that constitute "observation reports" and sentences that state hypotheses) rather than observed objects and hypotheses or observations and hypotheses.¹² (Sometimes, when discussing

⁸ See (Hempel 1945a, 13). Although Hempel insists, for certain technical reasons, that Nicod's condition can only be taken as providing a sufficient condition for confirmation "if we restrict ourselves to universal conditional hypotheses in one variable". See his note 1 on the same page for why he regards this restriction as essential.

⁹ (Hempel 1945a, 14)

¹⁰ (Goodman 1983, 70)

¹¹ (Hempel 1945b, 108-110)

¹² See (Hempel 1945a, 22-26). In this article, Hempel appears to use the term 'sentence' and the term 'statement' interchangeably. I will do the same.

Hempel's views, I will speak as if either observations or observed objects serve as one of the terms of Hempel's confirmation relation, but when I do, it should be kept in mind that this is merely a loose manner of speaking). Hempel states that "confirmation as here conceived is a logical relationship between sentences, just as logical consequence is." He goes on to explain that, on this conception of confirmation, just as "whether a sentence S_2 is a consequence of a sentence S_1 does not depend on whether S_1 is true (or known to be true) ... analogously, the criteria of whether a given statement ... confirms a certain hypothesis cannot depend on whether the statements in the report are true, or based on actual experience, or the like."¹³

Second, Hempel's theory accommodates a condition on confirmation that he refers to as "the special consequence condition." According to the special consequence condition, "if an observation report confirms a hypothesis H , then it also confirms every consequence of H ."¹⁴

Hempel attempts to dissolve the paradox of the ravens, not by denying the paradoxical conclusion, but by trying "to show that the impression of the paradoxical character ... is due to misunderstanding and can be dispelled."¹⁵ According to Hempel, the reason that it seems paradoxical to us that observations of non-black, non-ravens confirm the generalization that all ravens are black is because "we are often not actually judging the relation of the given evidence, E alone to the hypothesis H (we fail to observe the 'methodological fiction', characteristic of every case of confirmation, that we have no relevant evidence for H other than that included in E)."¹⁶ Hempel argues, for example,

¹³ (Hempel 1945a, 25)

¹⁴ (Hempel 1945b, 103)

¹⁵ (Hempel 1945a, 15)

¹⁶ (Hempel 1945a, 20)

that if we are testing the hypothesis that sodium salt burns yellow, and we happen to have at our disposal the prior information that the particular substance we are about to burn is ice and that ice contains no sodium salt, then “of course, the outcome of the experiment can add no strength to the hypothesis under consideration.” But, Hempel also argues, in the absence of such background information, discovering that a particular substance that did not turn the flame yellow is not sodium salt does confirm that hypothesis.¹⁷ Although Hempel does not spell it out explicitly, presumably we are to accept a parallel solution to the raven paradox: If we already know beforehand that an object is a non-raven, then discovering that it is not black adds no support to the hypothesis that all ravens are black; but, if we don’t have such prior information, then discovering that a non-black object is a non-raven does lend support to that hypothesis.

Goodman accepts that Hempel’s theory of confirmation is capable of handling the paradox of the ravens.¹⁸ But, he says, when we reflect on other matters, “new and serious trouble begins to appear.”¹⁹ In particular, Goodman states, “Confirmation of a hypothesis by an instance depends rather heavily upon features of the hypothesis other than its syntactical form.”²⁰ In support of this claim, Goodman asks us to consider the predicate ‘grue’, a predicate that “applies to all things examined before [time] *t* just in case they are green but to other things just in case they are blue.”²¹ “At time *t*”, Goodman notes, “we have, for each evidence statement asserting that a given emerald is green, a parallel

¹⁷ (Hempel 1945a, 19-20)

¹⁸ See (Goodman 1983,70-72, 75). Here, Goodman, like Hempel, offers solutions that accept the paradoxical conclusion but argue that the conclusion only feels paradoxical because we are importing additional background information into our assessments rather than considering the confirmation relations that obtain in the absence of such background information. In fact, Hempel (1945a, 21 n.1) attributes “the basic idea” behind his own solution to the paradox of the ravens to Goodman.

¹⁹ (Goodman 1983,72)

²⁰ (Goodman 1983,73)

²¹ (Goodman 1983, 74)

evidence statement asserting that that emerald is grue.” Thus, as Goodman goes on to explain, it appears that the prediction that all emeralds not examined before t are blue is equally well confirmed by our evidence as the prediction that all emeralds not examined before t are green.²²

One might be tempted to think that the trouble here lies in the peculiar way that ‘grue’ is defined. In particular, ‘grue’ is characterized in such a way that its definition refers to a time; it is not, as the positivists of the day would put it, a “purely qualitative predicate.”²³ So, perhaps, one might hope, we can find a way to distinguish, on purely syntactical grounds, those predicates which are purely qualitative from those which are not, and to allow only those predicates which are purely qualitative to figure into our evidence statements, thereby blocking the paradox. But alas, Goodman shows us, this cannot be done.

Goodman asks us to consider the predicate ‘bleen’, a predicate that applies to all objects examined before time t just in case they are blue but to all other things just in case they are green. He then describes how, among the predicates ‘green’, ‘blue’, ‘grue’, and ‘bleen’, which of these predicates may be seen as purely qualitative depends entirely on a (syntactically) arbitrary choice of primitives:

True enough, if we start with “blue” and “green”, then “grue” and “bleen” will be explained in terms of “blue” and “green” and a temporal term. But equally truly, if we start with “grue” and “bleen”, then “blue” and “green” will be explained in terms of “grue” and “bleen” and a temporal term; “green”, for example, applies to emeralds examined before time t just in case they are grue, and to other emeralds just in case they are bleen. Thus qualitiveness is an entirely relative matter and does not by itself establish any dichotomy of predicates.²⁴

²² (Goodman 1983, 74)

²³ See, for example, (Carnap 1947, 146-147). Here Carnap, in response to considerations raised by Goodman, tentatively commits himself to the claim that all (and perhaps only) purely qualitative predicates are projectible.

²⁴ (Goodman 1983, 79-80)

Thus, Goodman thought that his paradox showed that no purely formal, syntactical theory of confirmation could be adequate, and that additional, non-syntactical considerations had to be taken into account in any adequate theory of inductive confirmation.²⁵

As previously noted, Goodman took Hempel to have a successful solution to the paradox of the ravens, but he did not take Hempel (or any proponent of a purely formal, syntactical theory of confirmation) to have a solution to his own paradox involving predicates like ‘grue’. Interestingly, Hempel later conceded this point to Goodman.²⁶

R.D. Rosenkrantz has noted, however, that there is at least one respect in which

Goodman’s paradox is quite similar to Hempel’s paradox of the ravens:

Hempel’s paradox of the ravens is that white crows, yellow tulips, etc., being nonblack ravens, confirm the raven hypothesis. Similarly, green emeralds examined before time t , being nonblue emeralds not examined before t , confirm (à la Hempel) the hypothesis that all emeralds unexamined before t are blue. In this one of its aspects, Goodman’s paradox seems indistinguishable from Hempel’s.²⁷

In what follows, I develop and expand upon Rosenkrantz’s suggestion and argue that the two paradoxes are, in fact, equivalent.

I will argue for the conclusion that the paradoxes are equivalent in two stages corresponding to the following two sections. In the section that immediately follows, I will show how Goodman’s paradox can be reduced to Hempel’s paradox. In the subsequent section, I will show how Goodman’s paradox can be built up from Hempel’s paradox. After I have completed the following two sections, I will conclude by testing my claim that the two paradoxes are equivalent against three historically prominent proposed solutions to Hempel’s paradox. I will argue that, in each case, as my claim that

²⁵ (Goodman 1983, 70)

²⁶ (Hempel 1965, 50-51)

²⁷ (Rosenkrantz 1982, 85)

the two paradoxes are equivalent entails, the proposed solution to Hempel's paradox succeeds only if a corresponding solution to Goodman's paradox does.

I. Reducing Goodman's Paradox to Hempel's Paradox

We may begin our reduction of Goodman's paradox to Hempel's by stripping away from Goodman's paradox all that is not essential to it. Recall that 'x is grue' =_{def} 'x is green if x is examined before t and x is blue if x is not examined before t'.²⁸ We can begin to simplify matters by introducing the following abbreviation: Let's say that x is "preobserved" if and only if x is examined before t. We can also simplify matters by noting that, while having the grue hypothesis entail that all non-preobserved emeralds are blue might make that hypothesis more colorful, it is not essential to the paradox that it include such a specific entailment. What makes for the paradox is simply that, by observing green emeralds, we seem to acquire evidence for the counterinductive hypothesis that all non-preobserved emeralds are some color other than green. So, keeping all of the above in mind, let's introduce the following simplified and modified definition of Goodman's original 'grue' predicate (call the new predicate "grue*"):

'x is grue*' =_{def} 'x is green if x is preobserved and x is non-green if x is non-preobserved'²⁹

We may also note that it is not essential to Goodman's paradox that the grue hypothesis be about emeralds (indeed, not only is this not essential to the paradox, it is something of a distraction, since, arguably, we have background knowledge that emeralds

²⁸ To just assert that the predicate 'grue' is to be understood in this way is a bit tendentious, given that there is some controversy concerning this matter. Nevertheless, it seems obvious to me that this definition (or at least one that, given the incompatibility between 'green' and 'blue', is logically equivalent to it) is what Goodman had in mind. See (Israel 2004) for both a summary of the controversy over how 'grue' is to be understood as well as an argument for the conclusion that it is to be understood in a way that is logically equivalent to the definition that I have provided.

²⁹ Here I follow Fitelson (2008, 616; see also n. 4) in making this simplification.

belong to a class of things that are uniform in color).³⁰ So let's further strip Goodman's paradox down to its essentials by picking out some arbitrary class, C (C might be the class that includes all and only those marbles in a certain urn, or those items on a certain island, or those objects in a certain room, or, perhaps, the class that includes all and only emeralds; it doesn't matter). And let's make the hypothesis that we are concerned with be the following:

H_{G^*} : All members of C are grue*

Note that H_{G^*} is equivalent to the conjunction of

H_{G^*1} : All preobserved members of C are grue*

with

H_{G^*2} : All non-preobserved members of C are grue*

Now suppose that all the members of C that we have examined so far are both preobserved and green. It is worth noting that there is nothing paradoxical, as such, about taking the fact that all the preobserved members of C that we have examined so far are green to provide us with confirmation for H_{G^*1} . We are already pretheoretically inclined to believe that observations of green members of C confirm the hypothesis that all members of C are green, and that hypothesis entails H_{G^*1} . What is paradoxical, as such, is that our naïve pretheoretical belief that universal generalizations are confirmed by their instances (combined with an intuition to the effect that whatever confirms a hypothesis confirms what that hypothesis entails) seems to commit us to the claim that observations of green, preobserved members of C provide us with confirmation for H_{G^*2} . That is because H_{G^*2} is equivalent to the hypothesis that all non-preobserved members of C are

³⁰ Norton (2006, 196-198) points out that several contemporary accounts of induction can attempt to exploit such "symmetry breaking facts" as this one to resolve Goodman's paradox.

non-green, and so it is strange to think that our previous observations of green members of C confirm it.

Note that, in order to derive this paradoxical result, it appears that we are dependent not only Nicod's condition (taken as a sufficient condition), but on the special consequence condition and the equivalence condition. Nicod's condition is what gives us the result that observations of preobserved, *grue** members of C confirm the generalization that all members of C are *grue**. But it would initially seem (although see below) that it is only by combining this result with the special consequence condition that we are able to derive that such observations confirm the generalization that all *non-preobserved* members of C are *grue**.³¹ And it is only by further combining the latter result with the equivalence condition that we are able to derive (via fact that the generalization *All non-preobserved members of C are grue** is equivalent to *All non-preobserved members of C are non-green*) the paradoxical conclusion that observations of preobserved, green members of C confirm the (seemingly counterinductive) generalization that all non-preobserved members of C are non-green.

In summary, what is paradoxical, as such, about Goodman's paradox is that it seems to show that our observations that various members of a class are green confirm the intuitively counterinductive hypothesis that other members of that class are non-green.³² More abstractly, what is paradoxical here is that we seem to have the conclusion that the observation that various members of a class are Fs confirms the intuitively

³¹ This condition is one that Bayesians reject. See, for example, Rosenkrantz (1982) who employs the Bayesian rejection of this principle as part of his own Bayesian resolution to Goodman's paradox (see pp. 79-80, 86).

³² Rosenkrantz (1982, 85-86) gives an almost identical analysis of what is paradoxical about Goodman's paradox in the process of offering his own Bayesian solution to it.

counterinductive claim that other members of that class that we have not observed are non-Fs.

Consider the similarity to Hempel's paradox here: Again, suppose that we are given some arbitrary class of things, a class that, for all we know, contains ravens (it could be the birds on a certain island, the animals in a certain zoo, etc.). Call this class C^* . Suppose also that so far everything we have observed from C^* is both non-black and a non-raven. Suppose further that we know little about the color properties of ravens. We saw how Hempel's paradox seems to show that our observations of these non-black members of C^* provide us with confirmation for the hypothesis that all the ravens in C^* are black.³³ So we have it, then, that observations that various members of a class are Fs (in this case, non-black things) appear to confirm the intuitively counterinductive generalization that other members of that class that we have not observed are non-Fs (in this case, black things).

Here I have just expanded on Rosenkrantz's observation that the paradoxical content of Goodman's paradox appears to be identical (at least in this respect) to the paradoxical content of Hempel's paradox. In fact, as Rosenkrantz himself points out, in this respect, "[Goodman's paradox] does not really turn on the introduction of bizarre predicates like 'grue'." "Just as white crows, being nonblack nonravens, confirm the raven hypothesis (on Hempel's account), green emeralds found before time t confirm the hypothesis that all emeralds not examined before t are blue." "And this inference, far

³³ Note that nothing hinges on the domain of quantification being unrestricted as far as the derivation of Hempel's paradox is concerned. The generalization *All raven members of C^* are black* is logically equivalent to *All non-black members of C^* are non-ravens*. From the claim that generalizations are confirmed by their positive instances, we get the conclusion that observations of things that are both non-black members of C^* and non-ravens confirm the latter generalization. And, by the equivalence condition, we get the result that such observations also confirm the former generalization.

from being ‘inductive’,” Rosenkrantz notes, “is seemingly ‘anti-inductive’.” “Yet,” Rosenkrantz continues, “if the confirmation of the raven hypothesis by white crows or red herrings is genuine, so is the confirmation of the hypothesis that emeralds not examined before time t are blue by finding that emeralds examined before t are green.”³⁴

As Rosenkrantz suggests, we can get the paradoxical conclusion that observations of preobserved, green members of C confirm the hypothesis that all non-preobserved members of C are non-green by taking Hempel’s route to generating the paradox of the ravens. We need only note that (by Hempel’s account) observations of preobserved, green members of C confirm the generalization *All green members of C are preobserved* and that this generalization is logically equivalent to *All non-preobserved members of C are non-green*.³⁵ In taking this route, furthermore, we are not even dependent on the special consequence condition (as it seemed that we were in the explanation of Goodman’s paradox offered above). The equivalence condition (combined with the principle that universal generalizations are confirmed by their instances) is all we need.

At this point, however, one might be tempted to think that I have masked over an important difference between these two paradoxes. I have described Hempel’s paradox as if it (like Goodman’s paradox) seems to furnish us with a case of counterinductive confirmation. But, one might protest, what makes it seem paradoxical that observations of non-black, non-ravens confirm the hypothesis that all ravens are black is that we are pretheoretically inclined to believe that such observations simply have no evidential bearing whatsoever on that hypothesis. In short, the objection is that in Hempel’s

³⁴ (Rosenkrantz 1982, 78-79)

³⁵ See (Nola and Sylvan 1994, 2-3) for a formal exposition of Rosenkrantz’s line of reasoning here.

paradox we seem to have a case of *irrelevant* confirmation, whereas in Goodman's paradox we seem to have a case of *counterinductive* confirmation. Therefore, this objection has it, their paradoxical content is not the same.

But this supposed difference between the paradoxes is illusory. Or, at the very least, if there is such a difference, it is superficial enough for us not to pay attention to it in our philosophical reflections. Suppose that we know almost nothing about the color properties of ravens and suppose also that all of the members of C^* that we have observed so far are brown birds of a variety of different species that are not ravens. Intuitively, it seems like our observations so far positively confirm the hypothesis that all of the birds in C^* are brown. So, in this case, it appears that taking observations of brown birds in C^* to be evidence for the hypothesis that all ravens in C^* are black (as Hempel's paradox would have it) is counterinductive in just the same way that taking observations of preobserved green emeralds to be evidence for the hypothesis that all non-preobserved emeralds are non-green is counterinductive.

In the other direction, suppose that we know that C contains only emeralds and reptiles as members. Suppose we also know that we just so happened to have sampled all and only the emeralds that are in C up to the present time, t (the time that figures into our definition of 'grue*'), and have found them all to be green. In this case, it intuitively seems that the evidence that all the members of C that we have observed so far (i.e. the emeralds) are green is simply irrelevant to hypotheses about the color of the remaining objects in C (i.e. the reptiles). But, contrary to our intuitions on this point, Goodman's paradox has it that our current evidence supports the hypothesis that all of the remaining

objects in C are non-green. In this case, as in the case of Hempel's paradox, what seems paradoxical is that we are provided with intuitively irrelevant confirmation.

The fact that Goodman's paradox can be reduced to a Hempel-style paradox, in the manner I (following Rosenkrantz's lead) suggested, goes a long way toward showing that the two paradoxes are equivalent. But if they are equivalent, it should not only be possible to reduce Goodman's paradox to a Hempel-style paradox without sacrificing any of the paradoxical content of the former, it should also be possible to build up a Goodman-style paradox from Hempel's paradox without adding any new paradoxical content to the latter. In the next section, I show how this can be done.

II. Deriving Goodman's Paradox from Hempel's Paradox

Consider the following two hypotheses:

H_{NR} : All non-raven members of C^* are non-black

H_R : All raven members of C^* are black

Note that by a straightforward application of the principle that universal generalizations are confirmed by their instances, we have the result that observations of non-black, non-ravens confirm H_{NR} . And there is nothing paradoxical about this result as such. For, if we were testing H_{NR} , what we would be inclined to do is sample non-raven members of C^* and see whether any of them were black. What is paradoxical, though, is the claim that observations of non-black, non-ravens that are members of C^* confirm H_R (this just is the paradoxical result noted by Hempel). In this respect, the relationship between H_{NR} and H_R is parallel to the relationship between H_{G^*1} and H_{G^*2} described in the previous section.

Indeed, the parallel here is even tighter than it initially appears. Let's introduce the following grue-like predicate:

'x is blaven' =_{def} 'x is black if x is a raven and x is non-black if x is a non-raven'

Now observe that H_{NR} and H_R are equivalent to the following two hypotheses (respectively):

H_{B1} : All non-raven members of C^* are blaven

H_{B2} : All raven members of C^* are blaven

Given that we accept that observations of non-black, non-ravens confirm both H_{NR} and H_R , the equivalence condition commits us to the claim that observations of non-black, non-ravens also confirm both H_{B1} and H_{B2} . And just as it does not seem paradoxical to take observations of non-black, non-ravens to confirm H_{NR} , though it does seem paradoxical to take those observations to confirm H_R , so it also does not seem paradoxical to take observations of non-black, non-ravens to confirm H_{B1} , though it does seem paradoxical to take them to confirm H_{B2} .

Now, to further draw out the parallel between what we have so far and Goodman's paradox, suppose that you, who (let us pretend) are ignorant of the color properties of ravens, are sampling a class of birds, all of which, so far, you have observed to be brown, non-ravens of various species. Suppose also that I ask you which universal generalization about the color of ravens in that class you think your evidence most strongly supports. Naturally enough, you might well answer that you think it most strongly supports the hypothesis that all the ravens in that class are brown. At this point, however, suppose I explain to you the meaning of the predicate 'blaven' and argue that you have no better grounds for thinking that your evidence most strongly supports the

hypothesis that all the ravens in the class are brown than you do for thinking that it most strongly supports the hypothesis that all the ravens in the class are blaven. I further argue that it follows from this that you have no better reason to think that your evidence more strongly supports the intuitively inductive hypothesis that all the ravens in the class are brown than the intuitively counterinductive hypothesis that all of them are black. How might you be tempted to respond to me?

One way that you might be tempted to respond is to reply that my predicate ‘blaven’ has a logically complex definition whereas the predicates ‘black’ and ‘brown’ are simple and primitive. And for that reason, you might be inclined to say, ‘blaven’ is a suspect predicate when it comes to making inductive projections whereas ‘brown’ and ‘black’ are not. But suppose I then counter you by introducing the following two predicates:

‘x is blaven*’ =_{def} ‘x is black if x is a raven and x is brown if x is a non-raven’

‘x is naven’ =_{def} ‘x is brown if x is a raven and x is black if x is a non-raven’

I also point out that if we take ‘blaven*’ and ‘naven’ as our primitives, we can define ‘black’ and ‘brown’ as follows:

‘x is black’ =_{def} ‘x is blaven* if x is a raven and x is naven if x is a non-raven’

‘x is brown’ =_{def} ‘x is naven if x is a raven and x is blaven* if x is a non-raven’

So, I point out, it looks like we can make ‘brown’ and ‘black’ look logically complex by choosing the appropriate blaven-like predicates as our primitives. At this point in our conversation, I have merely replicated Goodman’s original paradox by replacing the

predicates ‘green’, ‘blue’, ‘grue’, ‘bleen’, ‘preobserved’, and ‘non-preobserved’ with ‘brown’, ‘black’, ‘blaven*’, ‘naven’, ‘non-raven’, and ‘raven’ respectively.³⁶

Note that my “ravenified” version of Goodman’s paradox turns entirely on the equivalence condition and the principle that universal generalizations are confirmed by their instances. I generated this paradox from Hempel’s paradox without appealing to any principles that were not already used to generate the original version of Hempel’s paradox. I have thereby shown in this section that a Goodman-style paradox can be generated solely from Hempel’s paradox. And in the previous section I showed how Goodman’s paradox could be reduced to a Hempel-style paradox. I conclude, therefore, that the two paradoxes are, in fact, equivalent.

III. Goodman’s Paradox and Proposed Solutions to the Paradox of the Ravens

Since Goodman’s paradox and Hempel’s paradox are equivalent, any successful solution to one of those paradoxes corresponds to a successful solution to the other. In this section, I add further support to this claim by testing it against three purported solutions to Hempel’s paradox, one proposed by Quine, another proposed by Israel Scheffler (who drew his inspiration from some of Goodman’s remarks), and finally against Hempel’s own proposed solution.³⁷ I will argue that, for each of these cases, the proposed solution

³⁶ One might be inclined to think that one significant difference between my “ravenified” version of Goodman’s paradox and Goodman’s original paradox is that the ravenified version does not employ any positional predicates. But I take the fact that we can generate Goodman-like cases of apparent counterinductive confirmation without introducing positional predicates to show that the introduction of positional predicates is not essential to Goodman’s paradox. Furthermore, I take the fact that we can have instances of Goodman’s paradox that do not involve the introduction of positional predicates to strengthen the force of the paradox.

³⁷ I thank an anonymous referee for encouraging me to consider Quine’s and Scheffler’s proposed solutions to Hempel’s paradox.

to Hempel's paradox succeeds if and only if a parallel solution to Goodman's paradox does.

Unlike the other two proposed solutions to Hempel's paradox that I will consider, adopting Quine's solution forces one to reject a purely syntactical theory of confirmation. Goodman argued that his own paradox, unlike Hempel's, showed that there was a need to distinguish those predicates that are inductively "projectible" from those that are not, and he further argued that this distinction could not be drawn on purely syntactical grounds. Quine follows Goodman in this and further proposes "assimilating Hempel's puzzle to Goodman's by inferring from Hempel's that the complement of a projectible predicate need not be projectible."³⁸ Thus, says Quine, "'Raven' and 'black' are projectible" but "'non-black' and 'non-raven' are not projectible."³⁹ He goes on to maintain that not only is it true on *some* occasions that the complement of a projectible predicate fails to be projectible, but that this is so *in every case*.⁴⁰ Quine's own favored account of what makes a predicate projectible, furthermore, is that a predicate is projectible just in case the set of its instances constitutes a natural kind.⁴¹ Thus, by Quine's suggestion, Hempel's and Goodman's paradoxes are both resolved by denying that the set of grue things and the set of non-black things constitute natural kinds.⁴² This fits well with my

³⁸ (Quine 1969, 115)

³⁹ (Quine 1969, 115)

⁴⁰ (Quine 1969, 116)

⁴¹ See (Quine 1969, 116-118, 128-129). There are, it should be noted, subtleties involved in how Quine is to be understood on this topic. Quine himself regards the notion of a natural kind (insofar as it is not analyzed in terms of more respectable scientific concepts) as scientifically dubious (116-117, 131, 133-134). He further notes that the claim that colors make for natural kinds is especially suspect (127-128). He also conjectures that, as a given branch of science matures, the similarity relations by which that branch groups things into natural kinds become analyzable in terms of other theoretical concepts (in the way in which, for example, chemical similarity can be analyzed in terms of molecular similarity which may, in turn, be analyzed in terms of atomic composition). According to Quine, when a branch of science manages to reduce its similarity concepts in this way, the notion of a natural kind (insofar as it is employed in that branch) is rendered both scientifically respectable as well as superfluous (135-138).

⁴² (Quine 1969, 115-116).

claim that any satisfactory solution to one of these paradoxes corresponds to an equally satisfactory solution to the other.

One might object, at this point, however, that the parallel between Quine's solutions to these paradoxes is not as tight as my thesis that the two paradoxes are equivalent would imply. That's because, in the case of Hempel's paradox, Quine supplies us with a general principle (namely that the complement of a projectible predicate is not itself projectible), one that allows to infer from the claim that 'black' is projectible that 'non-black' is not. But in the case of Goodman's paradox, we are not supplied with a principle that allows us to infer from the claim that the predicate 'green' is projectible that 'grue' is not. I do not believe, however, that this objection succeeds.

First, as noted in Section 2, Goodman's paradox can be generalized so as to yield the same counterintuitive result as Hempel's. It was there noted, for example, that the claim that generalizations are confirmed by their instances seems to commit us to the conclusion that observations of brown birds that aren't ravens confirm the generalization *All birds are blaven** and thereby (if we accept the special consequence condition) the generalization *All birds that are ravens are black*. Insofar as we have no general principle, furthermore, that entitles us to infer from the fact that the predicate 'green' is projectible that the predicate 'grue' is not, we also have no general principle that entitles us to infer from the fact that the predicate 'brown' is projectible that the predicate 'blaven*' is not.

Second, as noted in Section 1, there is a version of Hempel's paradox that delivers the same counterintuitive result as does Goodman's. It was there noted, for example, that the claim that generalizations are confirmed by their instances commits us to the

conclusion that observations of preobserved, green emeralds confirm the generalization *All green emeralds are preobserved* and thereby (if we accept the equivalence condition) also the generalization *All non-preobserved emeralds are non-green*. Now the obvious thing to say here, of course, given Quine's proposed solution to Hempel's paradox, is that the set of preobserved things does not constitute a natural kind and therefore that the predicate 'preobserved' is not projectible. But we can't derive this result from the general principle that the complement of a projectible predicate is not itself projectible. Presumably, the predicate 'non-preobserved' no more corresponds to a natural kind than 'preobserved' does. So it is false that endorsing that principle affords us with a general solution to Hempel's paradox. Here we have a version of Hempel's paradox to which that principle has no application. The claim, therefore, that Quine's proposed solution to Hempel's paradox can be rooted in a general principle that cannot also be appealed to in order to resolve Goodman's paradox turns out to be illusory.

Perhaps there are other proposed solutions to Hempel's paradox, however, for which there is no parallel solution to Goodman's paradox. Consider, for example, the following proposed solution to Hempel's paradox suggested by Israel Scheffler (who drew inspiration from Goodman's discussion of that paradox):⁴³

We may note that according to Hempel's theory of confirmation, observation reports of non-black, non-ravens not only confirm *All ravens are black* (relative to tautologous background information), they also confirm (relative to the same background information) *All things are non-ravens* as well as *All things are non-black*. But each of the latter claims entails *All ravens are non-black*. So it

⁴³ See (Scheffler 1963, 286-291), as well as (Goodman 1983, 70-71). What follows in the indented text below is my own adaptation and summary of Scheffler's solution to Hempel's paradox, not a direct quotation.

follows from Hempel's theory of confirmation (via the special consequence condition) that observation reports of non-black, non-ravens not only confirm *All ravens are black*, but also its contrary *All ravens are non-black*. And even though these two generalizations are not strictly inconsistent (since they both could be vacuously true), there's a clear sense in which they are rivals of one another (since they are *contraries*; if either is non-vacuously true, the other is false). And once we realize this, it no longer seems so counterintuitive that observation reports of non-black, non-ravens support the generalization *All ravens are black*.

If, in the manner suggested in the previous section, we replace the predicate 'blue' with the predicate 'black', and the predicate 'raven' with 'non-preobserved' (and make various other obvious compensating adjustments), we may (in mechanical fashion) transform this proposed solution to Hempel's paradox into a parallel proposed solution to Goodman's paradox. The result is as follows:

We may note that according to Hempel's theory of confirmation, observation reports of non-blue, preobserved emeralds not only confirm *All non-preobserved emeralds are blue* (relative to tautologous background information), they also confirm (relative to the same background information) *All emeralds are preobserved* as well as *All emeralds are non-blue*. So it follows from Hempel's theory of confirmation (via the special consequence condition) that observation reports of non-blue, preobserved emeralds not only confirm *All non-preobserved emeralds are blue* but also its contrary *All non-preobserved emeralds are non-blue*. And even though these two generalizations are not strictly inconsistent (since they both could be vacuously true), there's a clear sense in which they are

rivals of one another (since they are *contraries*; if either is non-vacuously true, the other is false). And once we realize this, it no longer seems so counterintuitive that observation reports of non-blue, preobserved emeralds support the generalization *All non-preobserved emeralds are blue*.

So far, the above solution to Goodman's paradox runs exactly parallel to Scheffler's proposed solution to Hempel's paradox. In both cases, Hempel's theory of confirmation ends up committing us to the initially paradoxical result that certain observation reports confirm a hypothesis that we are pre-theoretically inclined to believe they do not support. In the one case, this involves observation reports of preobserved, non-blue emeralds supporting the claim that all non-preobserved emeralds are blue. In the other, it involves observation reports of non-black, non-ravens supporting the hypothesis that all ravens are black. In each case, however, once we recognize that our theory of inductive confirmation entails that the same observation reports also support a rival hypothesis (the hypothesis that all non-preobserved emeralds are non-blue in the one case and the hypothesis that all ravens are non-black in the other), the initially paradoxical result becomes less counterintuitive.

Perhaps it is just here, however, that the parallels run out. As Scheffler observes, the current solution to Hempel's paradox seems to account well for our intuitive judgment that observation reports of black ravens manage to lend a kind of support to the hypothesis that all ravens are black that observation reports of non-black, non-ravens do not. This is due to the fact that, whereas observation reports of non-black, non-ravens confirm both the hypothesis that all ravens are black and the hypothesis that all ravens are non-black, observation reports of black ravens asymmetrically confirm the former

hypothesis over the latter (by confirming the former but definitively falsifying the latter). This fact also allows us (given knowledge of true observation reports of black ravens) to evidentially distinguish the intuitively inductive hypothesis that all ravens are black from the intuitively counterinductive hypothesis that all ravens are non-black.⁴⁴ Unfortunately, as Scheffler also points out,⁴⁵ it would seem that the same does not hold when it comes to the parallel solution to Goodman's paradox.⁴⁶

While we are not pre-theoretically inclined to regard observation reports of non-black, non-ravens as confirming the hypothesis that all ravens are black (under familiar conditions), we *are* pre-theoretically inclined to believe that observation reports of preobserved, non-blue emeralds confirm the hypothesis that all non-preobserved emeralds are non-blue. And the currently proposed solution to Goodman's paradox offers us no resources with which to evidentially distinguish the intuitively inductive hypothesis that all non-preobserved emeralds are non-blue from the intuitively counterinductive hypothesis that all such emeralds are blue. So it initially appears that Scheffler's solution to Hempel's paradox succeeds just where the parallel solution to Goodman's paradox fails.

I contend, however, that this initial appearance is misleading. *Both* of these proposed solutions fail, and for precisely the same reason. Consider, for example, the fact (one that was noted in the previous section) that our original observations might have consisted entirely of brown birds that were not ravens. We are pre-theoretically inclined to believe that, in that case, had our observations been sufficiently numerous and diverse,

⁴⁴ (Scheffler 1963, 286-291, 294-295)

⁴⁵ (Scheffler 1963, 298-301)

⁴⁶ I thank an anonymous referee for pressing me to consider this objection.

they would have provided us with strong evidential support for the hypothesis that all ravens are brown, and would not have afforded us with any support at all for the (in these circumstances) intuitively counterinductive hypothesis that all ravens are black. Not so, however, if (as Hempel's paradox would have it) observation reports of brown birds that aren't ravens also confirm the latter hypothesis. In these hypothetical circumstances, furthermore, we wouldn't have available to us any knowledge of true observation reports of brown ravens that would confirm the inductive hypothesis that all ravens are brown while definitively falsifying the counterinductive hypothesis that all ravens are non-brown. In these hypothetical circumstances, matters would have stood relative to the currently proposed solution to Hempel's paradox just as they actually do with respect to the parallel solution to Goodman's paradox. But any adequate solution to Hempel's paradox will account for our intuitions regarding what our evidence supports in hypothetical situations like this one (either by accommodating those intuitions or by explaining them away) and not just our intuitions concerning what it supports in the actual situation.

The problem that arises in this hypothetical situation generalizes, furthermore, so as to threaten to undermine all of our inductive reasoning, in just the same way that Goodman's paradox does. Call any raven that has 10,000 or fewer feathers, for instance, a "moderately feathered raven," and suppose that all of the ravens that we have observed so far are both moderately feathered and black. Suppose we were then to speculate about what to expect were we to observe a raven that has 10,001 feathers (i.e. a raven that is not moderately feathered). What color should we expect it to be? The intuitively correct answer, of course, is "black." Nevertheless, if the reasoning underlying Scheffler's

proposed solution to Hempel's paradox is correct, observations of moderately feathered, black ravens confirm both the hypothesis that all ravens are moderately feathered as well as the hypothesis that all black ravens are moderately feathered. Each of these hypotheses, in turn, entails that all non-moderately feathered ravens are non-black. So it now looks as if we have no more reason to prefer the intuitively inductive hypothesis that all non-moderately feathered ravens are black to the intuitively counterinductive hypothesis that all such ravens are non-black.

Given the qualitative diversity of the world (in both space and time), furthermore, in any case in which we are making inductive projections over a certain class of objects, there will *always* be some characteristics (even if highly relational ones) that we can be confident were not had by the items in the relevant class that we have already observed but are had by items in that class that we have not yet observed. And so the reasoning underlying the current solution to Hempel's paradox threatens to undercut *all* of our inductive projections, in just the same sort of way that Goodman's paradox does. Indeed, viewed from one perspective, Goodman's paradox can be seen as exploiting this very line of reasoning, taking advantage of the fact that non-preobserved emeralds are guaranteed to have a characteristic that the emeralds that we have observed so far don't have (i.e. that of being non-preobserved).

I conclude, therefore, that Scheffler's solution to Hempel's paradox, as well as the parallel solution to Goodman's paradox, both fail, and that they do so for precisely the same reason. Both of them fail to show how the paradox in question does not ultimately undermine all of our ordinary inductive reasoning. I'll conclude this

discussion by considering one more proposed solution to Hempel's paradox, namely, the solution proposed by Hempel himself.

As we have seen, Hempel did not deny the claim that observations of non-black, non-ravens confirm the generalization *All ravens are black*. Instead, he attempted to dispel the paradoxical feel of that claim. Recall that, according to the solution Hempel suggested, the above claim feels paradoxical to us because we often import extra background information into our evaluation of which hypotheses are supported by our observations, rather than considering the bearing that those observations have on those hypotheses in the absence of such background information. Hempel suggested, it may also be recalled, that in cases in which we already know that an object is a non-raven, observing that it is non-black adds no evidential support to the hypothesis that all ravens are black. But in the absence of such background information, observing that a non-black object is a non-raven does confirm the hypothesis that all ravens are black.

As Branden Fitelson points out, Hempel's solution to the paradox of the ravens is intuitively quite plausible. Fitelson notes that if we already know that an object is not a raven, then we already know that our observation of that object will neither furnish us with a positive instance of the generalization *All ravens are black* nor with a counterexample to that generalization. And, as Fitelson observes, it is intuitively plausible to think that if we already know that an observation will neither furnish us with a positive instance of a generalization, nor with a counterexample to it, then that observation will have no further evidential bearing (for us) on whether that generalization is true. But, as Fitelson also points out, if we don't know beforehand that an object is a non-raven, then to learn that it is a non-black, non-raven is also to remove it from the

class of potential counterexamples to the generalization *All ravens are black*. And for that reason, it is plausible to think that, on such background knowledge, observing a non-black, non-raven does provide us with evidential support for the generalization that all ravens are black.⁴⁷

Unfortunately, the intuitive claim, that Fitelson suggests is at the heart of Hempel's solution to the paradox of the ravens, isn't quite sufficient to dissolve that paradox. That's because to know beforehand that an object is a non-raven is to know that it is not a counterexample to the generalization *All non-black things are non-ravens*, but it is not to know that it is not a positive instance of that generalization. And, with or without such background knowledge, if observing that an object is a positive instance of *All non-black things are non-ravens* is sufficient to provide one with evidential support for that generalization, it is also (given the equivalence condition) sufficient to provide one with evidential support for the generalization *All ravens are black*.

So what's needed to make Hempel's solution to the paradox of the ravens go through is not just the intuitive claim that Fitelson gestures toward (the claim that knowing in advance that a given item is neither a positive instance of, nor a counterexample to, a given generalization is sufficient to block whatever direct evidential support subsequent observations of that item might have lent to that generalization).

⁴⁷ See (Fitelson 2006, 97). Fitelson (2006, 97, 100-104) also notes that Maher (1999) provides a formal explication of this insight by employing a neo-Carnapian framework. Fitelson (2006, 100) further points out that Hempel cannot actually accommodate this solution to his [Hempel's] own theory of confirmation on account of the fact that his theory lacks the resources to distinguish between conditional confirmation relative to a particular body of background knowledge and unconditional confirmation. Nevertheless, in what follows I will largely ignore this last point. It is of interest, in any case, to assume that Hempel could have developed his theory in such a way as to accommodate the above distinction and to consider how that developed theory might have been capable of handling Goodman's paradox. Continue to bear in mind that the claim I am defending in this portion of the paper is merely a conditional one: *If* Hempel's theory of confirmation is capable of handling the paradox of the ravens, then it is also capable of handling Goodman's paradox. I am not committing myself to the truth of the antecedent.

What's needed, rather, is the claim that knowing in advance that a given item is *not a counterexample* to a generalization is sufficient to block whatever direct evidential support subsequent observations of that item might have lent to that generalization (*even if* those observations reveal the object in question to be a positive instance). But this claim also seems intuitively correct. What do we need to do in order to find out whether a given universal generalization is true? We need to find out whether there are any counterexamples to it. But if we already know beforehand that an object is not a counterexample to a given generalization, then we already know everything about that object that is relevant to finding out whether that generalization is true.

But note that if Hempel's solution to the raven paradox works here, it also seems to work in the case of Goodman's paradox. In ordinary cases, when we observe an emerald, we know, roughly, when our observations are going to be made. So, in most cases, we already know that the emerald in question is preobserved. And given that we already know that, we know that our observation will not furnish us with a counterexample to the generalization that all the non-preobserved emeralds are non-green. And so, if Hempel's solution to the raven paradox is correct, our knowing beforehand that an emerald is preobserved cancels out the evidential support that our observing that it is both preobserved and green otherwise lends to the generalization that all non-preobserved emeralds are non-green.⁴⁸ But suppose that we don't know

⁴⁸ In fact, Hempel (1960) notes this parallel between Goodman's paradox and the paradox of the ravens and reports a proposed solution (one that he adapts from one of Carnap's earlier responses to Goodman) that runs along similar lines (in this case, the response is framed in terms of a "requirement of total evidence"). Here is Hempel's adaptation of Carnap's response:

Carnap's objection would take this form: In the case of the prediction that the next emerald will be grue, *more* is known than that the emeralds so far observed were all grue, i.e., that they were either examined before *t* and were green or were not examined before *t* and were blue: it is known that they were all examined before *t*. And failure to include this information in the evidence violates the requirement of total evidence. (p. 461).

beforehand that a particular emerald is preobserved, and we want to test the hypothesis that all non-preobserved emeralds are non-green. One way that we might test that hypothesis is by attempting to eliminate various objects from being among the class of potential counterexamples to that generalization. And to learn that a particular green emerald is preobserved would be to eliminate that particular emerald from the class of potential counterexamples. And so, in that case, to discover that a particular emerald is green and preobserved would provide us with evidential support for the hypothesis that all non-preobserved emeralds are non-green. Here matters go exactly as they do with Hempel's proposed solution to the paradox of the ravens.

Granted, it is also true, on Hempel's theory, that by finding out that an emerald is both preobserved and green (without knowing beforehand that it was either), we acquire evidence for the generalization *All emeralds are green* (via the principle that generalizations are confirmed by their instances) and therefore also for *All non-preobserved emeralds are green* (via the special consequence condition), in addition to acquiring evidence for the generalization *All non-preobserved emeralds are non-green*. But neither of the first two of these generalizations entails the denial of the third (since, for instance, the first could be non-vacuously true while the second and third are both vacuously true).⁴⁹ In fact, given Hempel's theory of confirmation, finding out that an emerald is preobserved also provides us with confirmation for the generalization *All emeralds are preobserved*, and that generalization entails that the generalizations *All non-*

For Carnap's original presentation of the response that Hempel is adapting, see (Carnap 1947, 139-140).

⁴⁹ Fitelson (2008, 632-633) points this out as part of a response to Goodman's (1983, 74-75) argument that, given Hempel's theory of confirmation, any observation report confirms any hypothesis.

preobserved emeralds are green and *All non-preobserved emeralds are non-green* are both vacuously true.⁵⁰

Note further, that even in situations in which it is the case that we know beforehand that a particular emerald is preobserved, the above Hempelian solution to Goodman's paradox does not obviously block us from taking an observation report claiming that an emerald is green to confirm the generalization that all non-preobserved emeralds are green. If it did, this solution would provide Hempel with a rather hollow victory, since it would, in a good many cases, block us not only from making counterinductive projections to unobserved instances, but inductive projections as well.

Granted, the fact that we know beforehand that an emerald is preobserved does block us, given the Hempelian solution to Goodman's paradox offered above, from taking our observation that it is green to offer us *direct* support for the generalization *All non-preobserved emeralds are green* (because by knowing beforehand that an emerald is preobserved, we know that it is not a counterexample to that generalization). However, given Hempel's theory of confirmation, we can take observations of green emeralds (that we knew beforehand to be preobserved) to provide us with *indirect* evidential support for the generalization that all non-preobserved emeralds are green.⁵¹ That's because Hempel's theory of confirmation entails that observation reports of the form 'a is green

⁵⁰ And here emerges yet another symmetry between the proposed Hempelian solution to Goodman's paradox and Hempel's original solution to the paradox of the ravens. Some of Hempel's remarks suggest that he thought that observations of non-ravens, absent any further background information, tend to confirm the generalization *All things are non-ravens* and thus (via the special consequence condition) tend to confirm the generalization *All ravens are black* (see, for example, (Hempel 1945a, 20)) Goodman (1983, 70-71) says the same thing more explicitly. See also Maher (1999, 57) who attributes this solution to the paradox of the ravens to both Hempel and Goodman and who also criticizes it on the grounds that it relies on the special consequence condition, which Maher takes to be false.

⁵¹ This contrast between direct evidential support for a hypothesis and indirect evidential support corresponds to Hempel's (1945b, 109) distinction between hypotheses that are "directly" confirmed by observation reports and statements that are confirmed by observation reports via being consequences of hypotheses that are directly confirmed.

and a is an emerald \top do directly confirm the generalization *All emeralds are green*. And so, given Hempel's special consequence condition, we may take the fact that our observations of preobserved, green emeralds provide us with evidential support for the generalization *All emeralds are green* to provide us with indirect evidential support for any statement that generalization entails, including the statement that all non-preobserved emeralds are green. But, as long as our observation reports are of the form $\top a$ is green and a is an emerald \top , we can find no analogous indirect evidential support (on background knowledge that already includes the fact that our samples are preobserved) for the generalization *All non-preobserved emeralds are non-green*.

But what about the fact that our knowledge that an emerald is green and preobserved entails that it is *grue**? Does that not also commit us to allowing statements of the form $\top a$ is a *grue** and a is an emerald \top to count as being among our observation reports? And don't observation reports of the form $\top a$ is a *grue** and a is an emerald \top directly confirm the generalization *All emeralds are grue**? And, for that reason, assuming that what we said about indirect evidential support above is accurate, don't we also have indirect evidential support for the generalization *All non-preobserved emeralds are non-green*, in spite of our background knowledge that the emeralds we are encountering are preobserved? So, doesn't it turn out that the Hempelian solution to Goodman's paradox proposed above fails for this reason? I have two observations to make concerning this objection.

First, I note that if the proposed Hempelian solution to Goodman's paradox fails for the above reason, so does Hempel's own proposed solution to the paradox of the ravens. It is also the case that our knowledge that a particular item is a non-raven and

non-black entails that it is blaven. So if we grant that we are committed to allowing reports of the form ‘ a is a grue* and a is an emerald’ into the class of observation reports for the reasons offered above, it seems that we are also committed to allowing statements of the form ‘ a is blaven and a is a bird’ into the class of observation reports. And so, even given background knowledge that the birds we are sampling are non-ravens, observations of non-black, non-raven birds would provide us with direct evidential support for the generalization that all birds are blaven, and thereby with indirect evidential support for the generalization that all the ravens are black. So if the Hempelian solution to Goodman’s paradox offered above fails, Hempel’s solution to the paradox of the ravens also fails for parallel reasons.

Second, it is not entirely clear that Hempel is committed to allowing statements of the form ‘ a is a grue* and a is an emerald’ or of the form ‘ a is blaven and a is a bird’ to count as genuine observation reports. The reason that this is not clear is that Hempel explicitly commits himself to an observational-theoretical distinction – the class of observation statements is, according to Hempel, to consist of expressions of “data accessible to what is loosely called ‘direct observation’.” Hempel further explains that these statements are to be given in a “language of science” using “‘observational vocabulary’ which consists of terms designating more or less directly observable attributes of things or events, such as, say, ‘black’, ‘taller than’, ‘burning with a yellow light’, etc., but no theoretical constructs.”⁵² Given such an observational-theoretical distinction, it is questionable whether statements expressed using predicates like ‘grue*’ or ‘blaven’ count as reports of data that is available via “direct observation” (for ordinary

⁵² (Hempel 1945a, 22-24)

human beings anyway). Ordinary human beings (who are well-positioned in ordinary light) can observe directly that an object satisfies the predicate ‘green’. They have to *infer* from such observations (and their background knowledge of when the object in question is being observed) whether that object satisfies the predicate ‘grue*’. The same goes, *mutatis mutandis*, for the predicates ‘non-black’ and ‘blaven’ respectively.

Granted, the observational-theoretical distinction has fallen on hard times lately. But many of the reasons that it has fallen on hard times are independent of considerations pertaining to Goodman’s paradox.⁵³ And insofar as the reasons that the distinction has fallen on hard times are independent of Goodman’s paradox, Goodman’s paradox does not pose any new difficulties for Hempel’s theory of confirmation than those that it already faced. Furthermore, it is not entirely clear that Hempel needs the sort of strong observational-theoretical distinction that has fallen into contemporary disrepute in order to discard statements of the form ‘ a is a grue* and a is an emerald’ from counting as known observation statements for ordinary human beings. Perhaps all he needs is a sufficiently strong distinction between what ordinary human beings learn by way of direct observation and what ordinary human beings learn by way of inference (and one does not need to posit a strong observational-theoretical distinction to recognize that there is such a distinction, even if it is not always a hard and fast one, and even if its boundaries are subject to change).^{54,55}

⁵³ What Goodman does seem to succeed in showing is that it would be hard to draw any such distinction on purely syntactical grounds. But Hempel does not appeal to syntax in order to explain the distinction; he appeals to the capacities of human beings and/or the techniques of observation used in a given scientific context. See (Hempel 1945a, 22-24).

⁵⁴ And, in fact, Hempel (1945a, 23) himself seems to take the distinction to be a flexible one, one that “obviously is relative to the techniques of observation used.”

⁵⁵ Hetherington (2001) offers a proposed epistemological solution to Goodman’s paradox that relies heavily on a distinction along these lines.

It seems that Goodman does show that Hempel cannot ban statements of the form $\lceil a \text{ is grue}^* \text{ and } a \text{ is an emerald} \rceil$ and of the form $\lceil a \text{ is blaven and } a \text{ is a bird} \rceil$ from counting as observation reports on purely formal, syntactical grounds. But that alone gives us no good reason to think that Hempel's purely formal program for explicating confirmation fails, no more than we have good reason to think that purely formal programs for explicating deductive reasoning fail because they cannot provide us with purely formal, syntactical criteria for deciding which premises in a deductive argument we are entitled to accept without further argument.⁵⁶

Recall that, strictly speaking, Hempel took his relations of confirmation to hold between *statements* and hypotheses rather than between observations themselves and hypotheses. Recall also that Hempel took the relations of confirmation that hold between statements and hypotheses to be objective and independent of whether the statements in question were true or known to be true. Given this fact, Hempel can accept that statements of the form $\lceil a \text{ is grue}^* \text{ and } a \text{ is an emerald} \rceil$ and $\lceil a \text{ is blaven and } a \text{ is a bird} \rceil$ bear objective, positive, confirmatory relations to the hypotheses that all emeralds are grue* and that all birds are blaven (respectively). He can accept all of this without accepting that statements of that form count as observation reports for ordinary human beings. He can do this in the same way that one can accept that the premises of a certain deductive argument entail their conclusion without accepting that they count as premises that ordinary human beings can know to be true without further argument.⁵⁷

⁵⁶ Hempel (1945a, 25) himself draws this analogy and says "The central problem of this essay is to establish general criteria for the formal relation of confirmation ... the analysis of the concept of a reliable observation report, which belongs largely to the field of pragmatics, falls outside the scope of this study."

⁵⁷ And what Hempel (1945a) himself says about his confirmation relation is quite congenial to his accepting these claims, in spite of his own later concession to Goodman that some predicates are not projectible. He states that "the general logical characteristics of that relation which obtains between a hypothesis and a group of empirical statements which 'support' it, can be studied in isolation from this

But couldn't there have been beings for whom such statements did count as observation reports? Might there not have been beings (human or otherwise) that did directly observe whether things are *grue** and who learned from those observations (in conjunction with knowledge of the time of observation) whether things were green by way of inference? And if (as we are inclined to suppose) our inductive projections are, in fact, the successful ones, wouldn't these hypothetical beings (who project predicates like *grue**) find their inductive generalizations going badly wrong? And if we are inclined to think that such is the case with them, what guarantees that, in fact, the roles aren't reversed, that it isn't really our projections that will go badly wrong rather than theirs? The right answer to this last question, I take it, is that we have no such guarantee, but that is nothing new – we've known about it at least since Hume. Neither we nor our hypothetical beings have any guarantee that the inductive generalizations supported by our evidence actually hold (keep in mind that, *ex hypothesi*, what is included in the hypothetical beings' evidence base – i.e. the class of observation reports they are entitled to accept – differs from what is in our evidence base, since different statements count as observation statements for us than for them). But that's the old problem of induction – no new riddles here.⁵⁸

In any case, if Hempel can ban statements like $\lceil a \text{ is } \textit{grue}^* \text{ and } a \text{ is an emerald} \rceil$ from counting as observation reports for ordinary human beings with ordinary background knowledge, then the Hempelian solution to Goodman's paradox goes

restriction of direct observability" and also "that we do not require an observation sentence to be true, nor to be accepted on the basis of actual observations" (p. 24). Hempel does say that "an observation sentence describes a possible outcome of accepted observational techniques" (24-25), but, as previously noted, he allows for the possibility that the accepted observational techniques may vary between contexts.

⁵⁸ For a similar point pertaining to Goodman's paradox and the actual evidence that ordinary human beings have versus the evidence that they or other hypothetical beings could have had, see (Hetherington 2001, 133-136).

through if Hempel's original solution to the paradox of the ravens does. On the other hand, if Hempel can't ban statements of the form 'a is grue* and a is an emerald' from counting as observation reports for ordinary human beings with ordinary background knowledge, it seems that he also can't ban statements of the form 'a is blaven and a is a bird' from so counting, and his solution to the paradox of the ravens fails to go through. Either outcome is consistent with my claim that Hempel's theory of confirmation is incapable of handling Goodman's paradox if and only if it is incapable of handling the paradox of the ravens.⁵⁹

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