Evidential Relevance and the Grue Paradox*

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Abstract

Goodman's Grue Paradox may be intransigent as a version of the problem of induction, but may be resolved within the more limited context of confirmation theory in which the task is to explicate the basic notion of evidential relevance. Although the green and grue hypotheses are equivalently confirmed if we follow Goodman's use of the Hempelian instance confirmation relation, there are asymmetries than can be exploited if we adopt an "ontic" confirmation theory that uses a causal notion of evidential relevance. I sort out a variety of interpretive confusions about the intended content of the definition of grue and show how the causal approach resolves each in a way that is not paradoxical.

1. Introduction

If we are to make progress in confirmation theory, we must distinguish local problems having to do with the nature of evidence from the global problem of induction. Nelson Goodman posed the Grue Paradox as "The New Riddle of Induction," but his presentation set up the problem within a Hempelian model of confirmation. In what follows I do not address the aspect of the paradox that participates in the old problem of induction but focus upon the aspect that deals with the explication of the confirmation relation, that is, the relation having to do with what counts as evidence of what. In §2 - §5 I highlight features of the para-
dox that are problematic when viewed with this particular question of evidential relevance in mind and in §6 I show how we may avoid the problems by moving from a syntactic/semantic to an ontic/causal relevance relation.¹

2. Will the Real Grue Paradox Please Stand Up?

The canonical statement of Goodman’s paradox occurs in Fact, Fiction and Forecast:

[The predicate ‘grue’] applies to all things examined before t just in case they are green but to other things just in case they are blue. Then at time t we have, for each evidence statement asserting that a given emerald is green a parallel evidence statement asserting that emerald is grue. And the statements that emerald a is grue, that emerald b is grue, and so on, will each confirm the general hypothesis that all emeralds are grue. (Goodman 1983 p. 74)

Much confusion arises in the literature because this definition of ‘grue’ is ambiguous and because philosophers sometimes discuss the paradox without specifying a precise form. I follow Putnam’s interpretation of the definition — “something [is] grue if it is either observed before a certain date and is green, or is not observed before that date and is blue.” (Putnam 1983, p. vii) The same form is used by Scheffler (1958, p. 23), Quine (1970, p. 41), Sober (1994), Stalker (1994, p. 2), and many others. Not only does this continue to be the most prevalent form, there are also good reasons to think that it is correct.

First, we may take a cue from Goodman’s original formulation of the paradox in “A Query on Confirmation” that used a similar predicate ‘S’ to mean “is drawn by VE day and is red, or is drawn later and is non-red.” (Goodman 1946 p. 383) This also lets us see that the intended contrast is not “examined” versus “not examined” but rather “before time T” and “at or after time T.” Indeed, recent presentations often omit the former element as inessential.² Formally, the problem relies on definitions of the following sort:

(1) $\text{Ex} \leftrightarrow x$ is an emerald
(2) $\text{Tx} \leftrightarrow x$ is before time T
(3) $\text{Ux} \leftrightarrow x$ is at or after time T
(4) $\text{Gx} \leftrightarrow x$ is green (at t)
(5) $B_x \leftrightarrow x$ is blue (at $t$)

(6) $x$ is grue (at $t$) $\leftrightarrow [(T_x \& G_x) \lor (U_x \& B_x)]$

(7) $x$ is bleen (at $t$) $\leftrightarrow [(T_x \& B_x) \lor (U_x \& G_x)]$

A second reason for considering the standard definition (6) is that other definitions do not generate the paradox in the way Goodman posed it. Frank Jackson (1975) and others have shown this for the following alternative definitions:

(8) $x$ is grue iff $x$ is green before $T$ and blue thereafter

which was used by Kyburg (1970), Hacking (1965), and Barker (1957), and for

(9) $x$ is grue at $t$ iff ($x$ is green at $t$ & $t < T$) or ($x$ is blue at $t$ & $t \geq T$)

which was used by Skyrms (1966), Salmon (1963), and Barker and Achinstein (1960). It would be useful to have a systematic survey that sorts out confusions of other formulations in the literature, but I'll proceed using definition (6).

When philosophers discuss the Grue Paradox with other ends in mind, they omit the framework of Hempelian confirmation theory in which Goodman presented the paradox. I include it because it is central to how the paradox relates to my question about evidential relevance. On Hempel's view, a scientific law is symbolized by a universally generalized hypothesis-statement and is confirmed by a true evidence-statement that is an instance of it. Hempel (1965) defined a special instance relation to solve some technical problems that we need not get into. For simplicity we may take an "instance" to be defined syntactically such that both the antecedent and the consequent of the conditional stating the universal generalization are satisfied. For example, "$E_a \& G_a$" is an instance of the hypothesis ""$x$($E_a \rightarrow G_x$)." Thus, to provide the intended interpretation, the evidence-statement "a is an emerald and a is green" confirms the hypothesis "All emeralds are green." It is by virtue of the syntactically defined instance relation that the former statement counts on Hempel's confirmation theory as evidentially relevant to the given hypothesis.

However, if this instance relation is sufficient for confirmation, then we are in trouble, said Goodman, for the observation that a is a green emerald, if made before time $T$, also confirms the hypothesis "All emeralds are grue," and it is absurd to think that this observation also confirms generalizations containing predicates like "grue," which imply the "incompatible" prediction that "if an emerald subsequently examined is grue, it is blue and hence not green." (Goodman 1983 p. 74) He draws the moral that some generalizations are "projectible" (i.e., induc-
tively confirmable) and some are not, and that we must find a way to tell them apart, proposing his notion of “entrenchment” of a predicate to do this. Contrary to that, I will argue that instead of trying to disqualify predicates like grue we should reexamine the confirmation relation that licensed the same datum as equally relevant to both the green and grue hypotheses.

3. Confusions about Goodman’s Symmetry Argument

A typical reaction when one first hears Goodman’s paradox is to conclude that it arises because of the peculiar positional nature of the predicate “grue.” Carnap (1947) first made this point, arguing that we can disqualify grue-like predicates because they are not a “purely qualitative” (i.e., because they cannot be determined without consulting a time-piece). However, Goodman countered, if we take “grue” and “bleen” as the “basic terms,” then it would be “green” and “blue” that would be defined by reference to time T. (Goodman 1983) This might be done in the following manner:

(10): Rx ← x is grue
(11): Lx ← x is bleen
(12): x is green ← [(Tx & Rx) ∨ (Ux & Lx)]
(13): x is blue ← [(Tx & Lx) ∨ (Ux & Rx)]

Thus qualitativenss is relative, and our preference for green and blue over grue and bleen is merely linguistic chauvinism.

Carnap aimed to show that green was privileged over grue because the latter contained an illegitimate time-reference, but Goodman parried by pointing out a symmetry in the definitions of the predicates, since the presence of the time reference depended upon which were taken as primitive. Goodman shows how to re-write the definition of green so that it contains a time-reference “if we start with ‘grue’ and ‘bleen.’ ” (Goodman 1983 p. 79) However, he does not justify the implicit claim that in this way “grue” and “bleen” do not still require a time-reference, which is needed for a complete symmetry with the original case in which they did but “green” and “blue” did not. Goodman has us “start with” grue and bleen as primitives because otherwise their definitions — (10) and (11) — would depend upon definitions (6) and (7), which are explicitly positional, so the symmetry would obviously fail. But can they work as “timeless” primitives?
Someone defending Goodman’s parry might ask that we imagine ourselves having been born on Grue-World and having learned its predicates as children, probably from Kermit the Frog on Sesame Street singing “It’s not easy being grue.” In philosophy class we would have discussed the problem of the missing shade of bleen. Someone on Grue-World, the story goes, would think of grue and bleen in exactly the same way that we think of green and blue; a Grueling would no more look at his time-piece to tell colors than we do. However, this conclusion is incorrect.

Imagine an inhabitant of Grue-World who has grown up in just the way described above — his name is Rip Van Winkle. One fine October day in 1986, say, he was hunting in the Catskills, admiring the leaves as they changed from grue to relow, and the clear bleen sky. Like his namesake from the Washington Irving story, he came across a group of strange men playing ninepins and drinking gin. He partook of a considerable amount of the liquor himself, causing him to fall into a deep sleep. We have read the story, so we know that he awakes 20 years later, after the millennial time T, but all poor Rip knows when he first awakes is that he feels stiff. Can he tell what color the leaves and sky are without consulting a clock/calendar? Rip notices that his gun is rusted and that he has a long beard, and surmises that he has slept a long time, but has it been five years or fifteen? Is the sky bleen or grue? Are the leaves still grue, or are they now bleen?

If Rip has only our own perceptual abilities then he cannot make a warranted identification of colors around him until he again fixes the time. Earlier the leaves on a nearby tree looked grue to him, but if the perception is the same upon waking he would probably call the leaves he sees “bleen” if he thinks “now” is after T, whereas he would call them “grue” if he thinks it is still pre-T. Perhaps he will experience a time-analog to the puzzlement we feel when we can’t identify the color of something seen under unusual lighting. In any case, with no more than our perceptual apparatus he cannot make a warranted identification. What if Rip has some paranormal (for us) perceptual ability? Even if Gruelings have some direct intuitive perception of Grue-World colors, this could only work by means of something that indicated one’s position relative to the boundary T (because such position is part of what “grue” means), and in such case Rip’s primitive identification of grue colors still relies upon the time reference. Thus, even someone who “starts with” grue and bleen as primitives cannot identify them without refer-
ence to the time, breaking the symmetry with green (i.e., at the level of primitives, though not at the level of definitional interchange).

One can see another reason for this asymmetry of the primitives if one keeps in mind the difference between learning a predicate by technical definition in terms of other primitives, and learning a predicate directly as a primitive. In his order of presentation Goodman relied upon our having previously learned the meanings of “grue” and “bleen” by technical definition when he turned the problem around and used them to define “green” and “blue”, but that procedure is unacceptable for an argument that is supposed to show a complete symmetry. The appropriate question to ask is whether it would be possible to learn the meanings of “grue” and “bleen” immediately as primitives, without the prior use of “green” and “blue” and without reference to time. (Note that this is not the same question as whether or not “grue” is a “purely qualitative” term.) The answer is that we could learn to use the term “grue” as a primitive but that we could not do so without reference to time. The process would be complex, but one could design a Sesame Street segment that teaches how to apply the term using a series of examples of correct and incorrect usages in much the same way that we teach the use of “green” as long as there was some time indicator that marked the Goodman boundary.

4. A Logical Confusion about Disjunctive Predicates

The purported symmetry between green and grue is incomplete, but we may not thereby dismiss Goodmanized positional predicates as Carnap had hoped. A time-element is not good reason to disqualify such predicates, for we would then also have to eliminate all predicates referring to dynamic properties. Furthermore, since Goodmanization is not restricted to time boundaries, we would also have to eliminate, for instance, predicates referring to a spatial boundary. Both consequences are unacceptable; in science and everyday life we do make use of such predicates, as Goodman himself pointed out with examples such as “Sung” and “Arctic.” (Goodman 1947). I hold that rather than trying to find a way to rule out gruesome predicates — by time-reference or entrenchment or whatever — we should look for a theory of evidence that can handle the testing of hypotheses that contain them. I reiterate that my interest in the paradox has to do with the question
of the relation of evidential relevance. Is the observation of the given emerald equally relevant as evidence for both the green and the grue hypothesis? Before we can make further headway on this question we must know what the hypotheses are postulating. In particular, what is the grue generalization hypothesizing about the world? Philosophers adamantly disagree on the answer to this question. I believe such disagreements may arise from conflicting interpretations about what the paradox is supposed to be about. This section tries to sort out some common confusions in the literature about whether or not the grue hypothesis implies that emeralds will change color or will be a different color after time T. Some confusions arise out of a simple logical error and others from differences in background assumptions about the intended meaning of the grue hypothesis and the sort of world in which it is posed.

To see the logical error, let us first reexamine what many find paradoxical about the possibility of confirming Goodmanized predicates. It is thought unacceptable that an observation today of an emerald evidentially supports the hypothesis that all emeralds are green and simultaneously supports the hypothesis that they are grue and thus will all be blue from time T. That this is the worry is clear from the way many philosophers discuss the problem. Goodman himself often writes as though this is the point:

If our critic is asking... why projections of predicates that have become entrenched happen to be those projections that will turn out to be true, the answer is that we do not by any means know that they will turn out to be true. When the time comes, the hypothesis that all emeralds are green may prove to be false, and the hypothesis that all are grue prove to be true. (Goodman 1983 p. 98-99)

What Goodman seems to be saying is that at T we will learn which hypothesis was true by looking at emeralds to see whether they are still green or whether they have turned blue. He made this same point explicitly immediately after introducing the definition of “grue”:

Thus according to our definition, the prediction that all emeralds subsequently examined will be green and the prediction that all will be grue are alike confirmed by evidence statements describing the same observations. But if an emerald subsequently examined is grue, it is blue and hence not green. (Goodman 1983 p. 74)
Many of Goodman’s commentators seem to accept this conclusion as well. Salmon makes use of just this point in trying to show that Goodmanized predicates are not purely ostensive.

This point is rather obvious. If we examine a number of grue things at about the time t … some just before and some just after, we will see that they do not look alike. Those examined before t will look different from those examined after t. (Salmon 1963 p. 260)

That is, those before will (to us) look green, those after, blue. I won’t multiply examples, but I cannot neglect to mention the humorous comment, attributed to Henry Kyburg, that Goodman’s paradox is the most pressing problem in philosophy today, since we have only until the year 2001 to solve it. Again, the implication is that we get to find out which hypothesis is true by seeing whether emeralds are blue then.

Interpreted this way, such statements are the result of a logical error, for nothing in the definition of “grue” requires that there be a color change from green to blue at the given time T. The standard definition of “grue” is a disjunction and for a disjunction to be true we need satisfy only one of the disjuncts. Consider the following emeralds:

![Figure 1: Possible Colors of Emeralds on Both Sides of the Goodman Boundary](image)

Speaking in our own tongue, it is clear that case (a) is green pre-T and is green post-T, that case (b) is green pre-T and is blue post-T, and so on. When speaking Goodmanian, however, we must think a little harder. Emerald (b) satisfies the first disjunct of definition (6), so (b) is grue, but so does emerald (a), so it is as
well. Continuing in this manner, interpreting the standard definitions strictly, we should say that emeralds (a), (b) & (c) are grue, and emeralds (a), (c) & (d) are bleen, following definition (7). The point is that an emerald may be grue and never (to us) change color to blue, as in case (a). Grue emeralds change from green to blue in only one possible world, (b), so we cannot say that the grue hypothesis implies a color change.

Equally important, at a given time it is possible for the emerald also to be green or blue. For example, before T, emerald (b) is green and grue, though after T it is grue and blue. Emerald (a) is both green and grue at all times, and propositions stating that fact are neither contradictory nor contrary. It is therefore possible (for example in a world in which all emeralds follow the (a) pattern), that the statement s “all emeralds are green,” “all emeralds are grue” and “all emeralds are bleen” are all true. Thus, on this interpretation, it is not a problem that both the green and the grue hypotheses are confirmed.

Now we reach the first ambiguity arising from different possible background assumptions about what is intended by the grue hypothesis. On the straightforward reading of the standard definition a given emerald may be labeled “grue” just in case it satisfies at least one of the disjuncts of the definition, and it keeps that designation no matter what its state is at other times. Indeed, one critic argued against the conclusion above that an emerald could be both grue and bleen on the grounds that Goodman’s intention was that if an emerald is grue then it must remain grue, not realizing that it can do so while also being bleen, as in (a) and (c). Others read the hypothesis as saying that “grue” applies to an emerald only “at time t.” This is misleading. If the grue hypothesis is supposed to be a natural law rather than merely a quirky socio-linguistic rule, then we must recognize that, because grue includes the time-relative color reference, attributing the predicate to an object at a specific time involves counterfactual claims about all other times as well. I will have more to say about the difference between the social and the natural law interpretations in §5. Here I make the point with a hypothetical example. Suppose that some tadpoles develop into frogs and others may develop into sharks. It is not legitimate to say that a given tadpole is a “tadfrog” or a “tadshark” now, at time t, as though such attribution is indifferent to what is supposed to happen later were the tadpole to continue its development.

So, given that the logical form of the grue hypothesis does not imply a differ-
ence in color across the boundary why do many philosophers, as we noted above, think that it does and that the grue prediction is "incompatible" with the green hypothesis? I suggest that the worry may arise because of mistakenly interpreting the original disjunction as a conjunction. If we wanted to be sure to imply the color change, we could replace the wedge with an & in definition (6) or use something like definition (8). On one of these conjunctive definitions only emerald (b) is grue, which is what many people assume that "grue" implied.³ Peter Gärdenfors, unwittingly makes the conjunction explicit in his definition.

Let us now call anything grue that is green before the year 2000 and blue after the beginning of year 2000. Similarly, 'bleen' means blue before 2000 and green thereafter. (Gärdenfors 1990 p. 80)

I say "unwittingly" because he immediately goes on to state the standard view that "this means that all emeralds examined up to now have been grue" (ibid. p. 80), which does not follow from the conjunctive definition. Gärdenfors compounds the error when trying to explain the symmetry argument, giving again a conjunctive definition (of green and blue in terms of grue and bleen). Then, one paragraph later, he switches back to disjunction when formulating his own Goodmanized predicate, "whack," which he defined as "white in Europe or black in Australia." This is the clearest example of what I find to be a common confusion in the literature.

So why not use the conjunctive definition? Two reasons. First, on the conjunctive definition we cannot know pre-T that a given green emerald is grue because, of course, a conjunction is true only when both its conjuncts are, and we cannot see until after T that it also satisfies the second conjunct. Second, the original evidence statement that the emerald we now observe is green is not an instance of the conjunctive grue hypothesis — that is [Ea & (Ta & Ga)] is not an instance of (x)[Ex → ((Tx & Gx) & (Ux & Bx))] — and thus would not count as evidence of it according to Hempelian confirmation within which the paradox is posed.

The paradox seems to have dissolved. On the disjunctive definition of grue, the confirmation of the grue hypothesis does not imply a color change nor is it incompatible with the green hypothesis. On the conjunctive definition, the evidence confirms the green hypothesis, but does not confirm the grue hypothesis.
Shortly I will add an assumption that will restore the incompatibility for the disjunctive case, but first let us take a moment to reflect upon the mistake in the original formulation.

5. A Causal Confusion: Natural Law vs. Social Convention

What might have been the cause of the logical confusion? I suggest that the cause was causality itself. More precisely, the error was the result of an incomplete separation of logical and causal aspects of the paradox. The Goodmanian predicates were defined formally, and the confirmation of the disjunctive grue hypothesis by the observation-statement \([Ea \& (Ta \& Ga)]\) followed because of Hempel’s syntactically defined confirmation relation. However, though Goodmanized colors were defined by a logical manipulation of ordinary color predicates, and so should have unique properties that are a function of their disjunctive form, they were treated as if they would behave exactly like ordinary colors. It is probably this assumption that made the symmetry argument look complete — it was assumed that we could “start with” grue and bleen, and that they would function as primitives on a par with green and blue. But as we have seen, the symmetry is not complete (though it would have been had grue behaved like an ordinary color).

The assumption may have entered quietly at the very beginning of the discussion when we interpreted “grue” as referring to a possible physical property in the world, rather than as merely a quirky linguistic convention. This is another background assumption that makes a difference to how we view the success of the paradox. After all, one interpretation of the definition of “grue” would be to regard it as an agreement to talk about ordinary colors in an unusual way. Why not spice up our linguistic practice by changing meanings after time \(T\)? Beforehand we may use “grue” to refer to green things and afterwards we may use it to refer to blue things. However, this kind of switch would not generate the paradox, since it only says that usage will change and nothing about whether the world will. On this interpretation the grue hypothesis would be a “social language law,” rather than, on the alternative interpretation, a “natural law.” We may confirm it before time \(T\) by checking our observation and the language law book, but would not worry about what would happen after time \(T\) except for the inconvenience of hav-
ing to translate old textbooks. Such a linguistic shift would be no more paradoxical than moving from one language to another.

By following the natural law interpretation instead, it is but a small step to think that grue and bleen would act as ordinary colors do. So, for example, it is easy to expect that if an emerald were wholly grue after time T, then it could not also be wholly green. This conclusion would be warranted for green and blue, but it was improperly assumed that Goodmanized colors would behave causally in the same way as regular colors, contra the simple logical implications of the disjunctive definitions. This could also account for the unconscious slip to the conjunctive form as well as the common conclusion that there would be a perceivable color difference across the boundary.

Indeed, it seems that causal assumptions are implicit even in our evaluation of the green hypothesis, when we concluded that it was projectible. Why think that “Emerald a is green” confirms that “Emerald a is green at all times” unless you have a theory that the phenomenological property green results from a causal structure that is time-invariant? I recommend that we make the causal assumptions explicit and fundamental in our theory of confirmation. The green and grue hypotheses were equivalently confirmed by the same observation statement from the point of view of Hempel’s syntactic evidential relevance relation, but we saw that there remains an ontic asymmetry. A relevance relation that depends upon the causal content, and not merely the form of the generalization therefore can potentially distinguish such cases. Compare the following hypotheses and corresponding evidence statements:

- **H1:** All emeralds are green.
- **H2:** All blades of grass are green.
- **H3:** All houses are green.

**Ev1:** Emerald a is green.

**Ev2:** Blade of grass a is green.

**Ev3:** House a is green.

The simple instance relationship that holds equally between the left and right statements is not sufficient to conclude that the latter are all equally relevant in standard situations. Causal differences properly allow us to evaluate these three differently. We may generalize H1 to all times and places because the green of emeralds is an effect of their defining molecular structure and we have evidence that the molecule is stable. We generalize H2 to all places but not to all times because, although the green color of blades of grass is an effect of their defining causal structure, that structure is biologically dynamic — the brown blade of grass at the
end of its lifespan is not a counter-example. On the other hand, we are unwilling to generalize H3; the fact that this house is green does not confirm that it will remain so, nor that other houses are green, because we know that a particular house color is not the result of any causal structure that defines the object as being a house. If it is correct that these three cases are relevantly different then Goodman’s other-worldly predicates were unnecessary to show differential projectibility; ordinary ones will do. These also undermine Goodman’s “entrenchment” criterion as the distinguishing feature of projectible predicates; “emerald,” “blade of grass,” and “house” are all equally entrenched, but the hypotheses containing these predicates are not equally projectible.

6. Riddle Reformulated and Resolved Causally

Other background assumptions can also make a difference to one’s assessment of the paradox. Some commentators realized that on the disjunctive definition of grue all emeralds could be both wholly green and wholly grue provided that no emeralds existed after time T, and added the premise “Some emeralds will exist after time T” to maintain the incompatibility. As we have seen, this does not work — emeralds may continue to be grue after time T without being blue. However, it is possible to force a color difference without moving to a conjunctive definition if one assumes a different premise, namely, that “Some emeralds will exist after the time T, that did not exist before.” Since there would be no way for newly formed emeralds to satisfy the definition except by virtue of the second disjunct, for them to be grue per the grue hypothesis they would have to be blue. (If one is not confident that new emeralds will form after T, we can reformulate the paradox in terms of escarole since we certainly expect there to continue to be new escarole plants.) I have not found anyone who discusses this possible background premise, but perhaps it was implicit for those who thought that the grue hypothesis did imply a color change across the boundary. This move restores the incompatibility of the green and grue hypotheses on the disjunctive definition.

Goodman had concluded that the problem was how to distinguish projectible predicates from unprojectible ones, and proposed his theory of entrenchment as the answer. However, this inadvertently diverted attention away from the confirmation theory that was presupposed in setting up the problem — Hempelian in-
stance confirmation theory. By forgetting this many commentators failed to recognize that a conjunctive definition of grue was a non-starter. However, the projectibility problem looks different if we reassess the confirmation theory in which the problem is embedded. Some philosophers have done this by moving to Bayesian confirmation relation. I want to endorse another option that has received little attention — moving to a causal confirmation theory. Richard Miller (1987) and I (1991) have each proposed such theories. Miller's confirmation relation is "epistemic" while mine is "ontic" in Salmon's sense as he applies the terms in the theory of scientific explanation (Salmon 1984). I discussed the relation of explanation and confirmation and the differences between the epistemic and ontic approaches in (Pennock 1995). Although Temple (1974) had earlier criticized Goodman from a causal perspective, Miller is the first to publish a causal confirmation theory and show how it might avoid the paradox. This is not the place to discuss what I take to be serious weaknesses with Miller's general theory or to defend of the details of my causal confirmation relation — the Hypothetico-Causal (H-C) method. Here I will outline my positive view and then rely upon some claims about evidence and causal tests that I hope the reader will accept without further justification now. Those who reject a realist notion of causal processes and powers will naturally reject any causal solution but I will not here defend what may seem to be an ill-advised leap from the frying pan back into the fire.

The H-C method is an "ontic" approach in that it holds that the evidential inferences we may draw are licensed by ontic relations — that is, by the causal structure of the world. Unlike the standard Hypothetico-Deductive (H-D) method, which says to check a prediction that is logically derived from the hypothesis-statement, on the H-C method one checks for something that would be a causal consequence of the kind of state of affairs proposed by the hypothesis. In the simplest case a causal consequence would just be an effect of that which is hypothesized, such as a fingerprint being evidence for the hypothesized identity of the murderer, though more generally we may include data that would have a causal connection to what is hypothesized or which is of the same causal type. On this view it is the fingerprint itself — not the statement "A is so-and-so's fingerprint" — that is the evidence. One state-of-affairs may be evidence of some other because it provides information about it, and causal processes are necessary to transmit information. We find out about causal processes using controlled experi-
ments and other standard tests. The grue and the green hypotheses are indistinguisha-
ble on Hempel’s confirmation relation, but since they are quite different as models of what is supposed to occur causally in the world we should not expect to be able to confirm them with the same set of observations if evidential relevance depends upon ontic relations. Furthermore, given how people differently interpret the grue hypothesis, we must require a clear statement of what they take it to be postulating about the causal structure of the world.

Emeralds are beryls with a high chromium content, which is what gives them their green color. As we saw above, we have good reason to project the green hypothesis because observing the emerald \( a \) as green is an effect of its causal structure and we have independent evidence that that structure is stable. We could perform experiments that change their color by removing chromium. Such observations are evidentially relevant to the green hypothesis on the causal view and would allow me to say that I have confirmed the statement “All emeralds are green.” Suppose now that our evidence has accumulated to the point that we put the hypothesis into our set of (defeasible) truths. We may disjoin any other statement to it, and by logic now say that the disjunction is also true, such as: “All emeralds are green or Elvis will return (at \( T \)).” Is it paradoxical to say that our observation evidentially supported this disjunction? No, so long as we are clear about the difference between the ontic relation and the linguistic one and do not improperly conclude that we have evidence that Elvis will return at time \( T \). So, for those who interpret the definition of grue this way (i.e., as a disjunction that does not imply that colors are different across the boundary), there is no paradox. We may think it odd to coin a term to tuck in an irrelevant disjunct but it makes no difference to the content of what has been confirmed about the structure of the world.

What about someone who thinks that the grue hypothesis is meant to be a merely social language law? As discussed above, this would be quirky but not paradoxical. The only ontic change it hypothesizes is a change in our linguistic behavior, and the observation of emerald \( a \) now is irrelevant to whether or not we will follow the convention and change the way we speak after \( T \). To find evidence of that sort of change we would have to look to psychology not to mineralogy.

What about those who intend that grue requires a color change (to us)? There is a good methodological reason to rule out of hand predicates that postulate such a change at a specific arbitrary time-reference because they make a mere point in
time causally relevant, and it is imprudent to ascribe causal power to space-time locations per se. (Such considerations also help explain why positional predicates like “Sun” and “Arctic” are projectible; in such cases there are causal factors at play that are not merely arbitrary space-time boundaries.) Nevertheless, a confirmation theory should be able to say something about what evidence would be relevant to confirm even a misguided hypothesis of this sort.

If someone insists that the grue hypothesis does require a color change (to us) at time T (whether of old or new emeralds), and that that is the factor of interest, then T, considered as the hypothesized cause of a color change, must become the focus of the test. To check whether T has such a causal power we will have wait until T and observe what happens. An observation of our emerald a now will not be relevant on the causal view, because we must check the effect of the proposed causal variable and because, by definition, there are no other cases of the same type that we can check in advance. We cannot say that an emerald a is grue now, because on this interpretation the grue hypothesis requires the change to occur later because of T. Of course, we cannot “introduce” the variable into a test situation, since time is not under our control. Furthermore, given that we lack time travel, T will not be repeatable. So, the causal approach tells us that our current observation of the emerald is irrelevant to this interpretation of the grue hypothesis.

To conclude, on the ontic theory of evidential relevance, whether a given observation counts as evidence for a Goodmanian hypothesis will depend upon the causal change proposed. According to this view, evidential relations depend upon the ontic content of the model, not just the logical form. As in Salmon’s theory of explanation, this view holds that evidence is not at base an argument but a feature in the world. Thus one cannot simply Goodmanize a causal predicate to try to undermine this proposal (though one can do so to undermine Miller’s epistemic causal approach). The price of this solution is that we must again confront old worries about causality, but there are plenty of other reasons to be a realist about causation and accept the challenge. Of course, even if we accept such a causal resolution to Goodman’s paradox viewed as a problem of evidential relevance, there remains the question of whether something that is green now will remain green in the future. Perhaps emeralds will be blue several years from now, perhaps even at time T. Having warranted evidential support for the green hypothesis
does not provide an answer to the skeptic. If Goodman’s puzzle were nothing more than skepticism, than nothing of what I said about an ontic notion of evidential relevance makes a difference. People once believed that emeralds had the power to predict the future, but mere scientific evidence can give no philosophical guarantee that the future will continue to be like the past.

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Notes

1. Although the Grue Paradox is one of the most debated problems in analytic philosophy, not only is there no generally accepted solution, there is also substantial disagreement about what is the nature of the problem. This is clearly exhibited in (Stalker 1994) which is the first broad survey of the literature on the topic and includes an annotated bibliography of 316 articles dealing with the paradox. Stalker counts twenty sorts of solution to “the” problem, but does not count the different interpretations of the problem. Philosophers have put Grue to various uses, and the paradox looks quite different depending upon what one thinks it is supposed to show. That this paper presents a new “solution” that does not appear in Stalker’s review is not surprising, given that I look at the paradox just as it applies to the question of evidential relevance.

2. Many have claimed that the time condition is also inessential and that the paradox works equivalently using any arbitrary boundary. This is not so generally, but depends upon what one takes to be at issue. For example, if the contrast were simply examined versus not-examined, then it would not be possible to examine those grue objects that are blue because by definition all examined ones are green. Such a boundary would be problematic but in an interestingly different way, in that a grue hypothesis could never be falsified.

3. Note that I am not assuming that the colors (for us) on Grue-World necessarily change at time T nor that thinking that they would have is the source of Rip’s puzzle. I discuss the question of whether or not the colors change in §4.
4. This problem is avoided by definitions like (9), but, as noted, these have been show to have other serious problems.

5. Note that this is not a point about the conjunctive syntax, since one could rewrite definition (6) in a logically equivalent form that uses & as the major connective. The key is the difference between requiring grue things to be certain colors (for us) either before or after T ("the disjunctive definition"), or for both times ("the conjunctive definition").

6. By "arbitrary" I am assuming that there is no special physical structure at the given T, as is certainly Goodman's intention.

REFERENCES


