Dragging and Confirming

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1. Preliminaries

In many cases where we get evidence for some claim, we also thereby get evidence for that claim's logical consequences. For example, I might collect evidence that my friend Joe is in New York, from which it follows (together with some background information about geography) that Joe is not in California, and I would take myself to have thereby collected evidence that Joe is not in California. Or researchers might collect evidence that some scientific theory T is true and take themselves to have thereby collected evidence that T's entailments (that is, its predictions) will come true. Thus, the principle that "If E is evidence for $H1$, and $H1$ entails $H2$, then E is evidence for $H2$" has struck many people as fairly intuitive.

This principle is essentially Hempel's "Special Consequence Condition" (Hempel 1965), though it is sometimes referred to in the epistemology literature as "Evidence Closure" to highlight both its similarities to and its differences from other closure-across-entailment principles such as Justification Closure and Knowledge Closure. Let's call this principle the **Consequence Principle**, or **CP**, for short. It is important not to confuse CP with other closure principles. For example, one version of Justification Closure says that if *E justifies belief in* $H1$, and $H1$ entails $H2$, then E justifies belief in $H2$ also. But this version of Justification Closure is a very different thesis than CP; since it is possible for E to constitute evidence for $H1$ (or $H2$) without justifying all-out *belief* in $H1$ (or $H2$), neither thesis looks to entail the other.[1]

1. Justification Closure doesn't entail CP since Justification Closure entails nothing

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In this essay, I will first describe in section 2 some prima facie counterexamples to CP. In section 3, I will survey and reject some supplementary assumptions that might be added to CP in order to handle these counterexamples. In section 4, I will propose another such supplementary assumption, which I call the **Dragging Condition**. After explaining and arguing for the Dragging Condition, I will argue in section 5 that the Dragging Condition provides a general account of, and solution to, the counterexamples with which we began. In section 6, I will briefly discuss the relevance of the Dragging Condition to the recently much-discussed topic of "transmission failure" in epistemology (see, for example, Beebee 2001; Brown 2003; Davies 2004; McKinsey 2003; McLaughlin 2003; Okasha 2004; Pryor 2011, forthcoming; Silins 2005; White 2006; Wright 2000, 2002, 2003, and 2004). In section 7, I will apply the Dragging Condition to the problem of "bootstrapping" in epistemology, and in section 8, I will discuss three important objections to my view.

But first, some preliminaries.

First, in what follows, I will make considerable use of probabilities. I will take these probabilities to be so-called evidential probabilities, or the subjective credences that rational agents are *justified* by the evidence in assigning. So, "$p_S(H \mid E)$," for example, will refer to the credence that it is rational for a subject S to assign to the hypothesis H after learning E.[2] In most of what follows, I will omit the subscript referring to the agent since nothing will turn on whose credence function is being considered.

Second, I will take a broadly Bayesian approach to the notion of evidence, according to which E is evidence for H just in case $p(H \mid E) > p(H)$. This notion of evidence is sometimes referred to (after Salmon 1975) as "relevance confirmation" or as "incremental confirmation"; I will use the word "confirms" to refer to justified credence raising of this sort. Understood this way, CP becomes

CP If $p(H1 \mid E) > p(H1)$, and $H1$ entails $H2$, then $p(H2 \mid E) > p(H2)$.

at all about E's effect on $H2$ when E is some evidence for $H1$ but fails to justify all-out belief in $H1$. And it's at least arguable that CP doesn't entail Justification Closure; perhaps, for all CP says, it's possible for E to provide evidence for and justify belief in $H1$ and yet to only provide evidence for (that is, without justifying belief in) $H2$.

2. There are some complications here, which are outside the scope of this essay, about the so-called Uniqueness Thesis that there is one uniquely rational epistemic response to any body of evidence. See White 2005 for a discussion.

There may well be ways in which the English words "evidence" and "confirms" deviate from this Bayesian analysis. But I think that CP has a good deal of intuitive plausibility even when it's read in the way that I'm recommending; so understood, it says that if we acquire a reason to become more confident in $H1$, and if $H1$ entails $H2$, then we've also acquired a reason to become more confident in $H2$.

Third, I will assume in what follows not just that $H1$ *does* entail $H2$ but that that entailment is *known* by the relevant agent. There are interesting and much-discussed complications to the Bayesian program that arise as a result of the fact that agents (even, plausibly, ideally rational ones) fail to be aware of all logical truths (see, for example, Earman 1992 and Howson and Urbach 1993), but such complications won't concern us here. All of the logical entailments that I will consider will be quite obvious; I will therefore assume that the agents under consideration see these entailments and appreciate their relevance.[3]

Finally, in what follows, I will assume without argument that the relata in the confirmation relation are *sentences*: for example, that "I'm having a visual experience as of a tree in front of me" confirms "There's a tree in front of me." I will also assume that the entities to which we attach credences are sentences. In fact, there are serious difficulties with both of these views, which I won't explore here. However, for my purposes, nothing essential will turn on this choice; I make it just for ease of exposition.

2. Problems with CP

2.1. The Certainty and Relative Certainty Problems

One problem with CP is that if $p(H2) = 1$, then E can't confirm $H2$ because the upper bound for classical probabilities is the value 1. And, of course, the condition that $p(H2) = 1$ and the condition that $p(H1 \mid E) > p(H1)$ are perfectly consistent. Suppose, for example, that we let E be "There appears to be a table in front of me," $H1$ be "There is a table in front of me," and $H2$ be the logically true sentence "Either snow is white or snow isn't white."[4] Then, E confirms $H1$, and $H1$ entails $H2$

3. Further complications here come from the fact that sometimes the realization that $H1$ entails $H2$ is a reason to become less confident in $H1$ (if, say, the agent has independent reason to have low confidence in $H2$) rather than more confident in $H2$. See Harman 1988.

4. If you don't like excluded middle, then substitute your favorite logical truth here instead (say, "All walruses are walruses"); nothing turns on the choice.

(since anything entails a logical truth), but E certainly doesn't confirm $H2$; $p(H2) = p(H2 \mid E) = 1$. So we have a (fairly obvious) counterexample to CP. Call this the **Certainty Problem**.

It's controversial whether and when a rational agent ever should assign a credence of 1 to any proposition other than a (known) logical truth, and I don't want to take a stand on this issue here, but it's fairly natural to think that there are some nonlogical sentences to which a rational agent is permitted (or even required) to assign a credence of 1.[5] For example, let E be "A reliable friend just told me that I am the shortest person in the room," $H1$ be "I am the shortest person in the room," and $H2$ be "I exist." Obviously, E confirms $H1$, and $H1$ entails $H2$, but it's implausible that E confirms $H2$ because it's natural to think that (on Cartesian grounds, say) I already rationally assigned a credence of 1 to $H2$ before learning E.[6] But regardless of *which* cases count as examples of the phenomenon, there are clearly cases in which E confirms $H1$, and $H1$ entails $H2$, but in which E fails to confirm $H2$ because the prior credence that the relevant agent assigned to $H2$ was already 1.

We could, of course, amend CP with a clause to deal with this phenomenon; for example, we could discard CP and instead endorse:

> **CP*** If E confirms $H1$, and $H1$ entails $H2$, and $p(H2) < 1$, then E confirms $H2$.

But CP* is arguably somewhat ad hoc, and it's not extensionally correct anyway. For one thing, we can generate cases with essentially the same problem as the case above even though $p(H2) < 1$. For example, consider a case where, even though I don't assign a credence of 1 to $H2$, I do think that $H2$ has already been confirmed as much as it can be *by evidence of E's type*.

Take the following case:

Experiment

> I know all of the following: Earlier this morning, I was in a room with nineteen other people. After rendering us unconscious, experimenters

5. Some philosophers have called propositions like this **self-evident**, though other philosophers mean something slightly different by this term.

6. Of course, when *you* are presented with this argument, *you* aren't going to assign a value of 1 to the prior probability that I exist. But when *I'm* confronted with the argument, it's natural to think that I will. And, of course, a precisely parallel argument can be constructed for you (that is, by putting the argument in your mouth, so that the indexical 'I' refers to you).

> chose one of the twenty of us at random, gave that person a hallucinatory drug that causes lifelike visual hallucinations of various (but unspecified) ordinary objects, and then placed that person in an empty room. The other nineteen people were placed in rooms filled with various (unspecified) real objects. Now, I find myself in a room, and I have yet to open my eyes.

Before I open my eyes, I assign a prior credence of .95 to "I'm in a room with other objects" since I know that nineteen of the twenty people were placed in rooms with other objects, and I don't yet have any evidence relevant to whether or not I was the person given the drug and placed in the empty room. I open my eyes and seem to see several objects, including a lamp and a cup; let E be "I'm having a visual experience as of a lamp and a cup." Of course, E leaves the credence that I assign to "I'm in a room with other objects" unchanged; regardless of whether I'm the person who got the hallucinatory drug or not, I was bound to seem to see various objects in the room,[7] and there's nothing special about the objects I in fact seem to see.

However, E certainly does confirm "I'm in a room with a lamp and a cup"; the credence that I assigned to *this* hypothesis before having the visual experience as of a lamp and the cup was presumably quite low,[8] whereas it is now .95. Let $H1$ be "I'm in a room with a lamp and a cup" and let $H2$ be "I'm in a room with other objects." Then, E confirms $H1$, and $H1$ entails $H2$, and yet E does not confirm $H2$. And here, it's not the case that the prior credence that I assigned to $H2$ was 1; rather, it was .95. In this case, $H2$ wasn't already confirmed to degree 1; it was merely confirmed as much as it could be by evidence of E's type (here, ordinary visual evidence).

Of course, in EXPERIMENT, $H2$ *could* be confirmed to a degree higher than .95 by some different type of evidence; assuming that it's part of my background knowledge that the hallucinatory drug causes

7. It's an elementary theorem of confirmation theory that E confirms H iff H confirms E—that is, that $p(H \mid E) > p(H)$ iff $p(E \mid H) > p(E)$. When we let E be "It seems to me as though I'm in a room with other objects" and let H be "I'm in a room with other objects," it's clear here that $p(E \mid H) = p(E) = 1$ since (given the experimental setup) I was certain to seem to see other objects. So it's not the case that $p(E \mid H) > p(E)$, so it's not the case that $p(H \mid E) > p(H)$.

8. This is, of course, assuming that the experimenters didn't tell us in advance *which* objects nineteen of us would find ourselves in room with (or which objects the twentieth person would have hallucinations of). So let's suppose that the experimenters weren't specific about this.

only *visual* (and never *aural* or *tactile*) hallucinations, then $H2$ would be confirmed to a degree higher than .95 if I were to touch the lamp and cup and feel their solidity, or if I were to hear an experimenter come into the room and tell me that I was not given the hallucinatory drug. So there's no reason *in principle* why $H2$ can't be confirmed to a degree higher than .95. It's just that E doesn't confirm $H2$ in this case (so it's not the case that $p(H2 \mid E) > .95$), despite the facts that E confirms $H1$ and that $H1$ entails $H2$. Call this the **Relative Certainty Problem**.

Because of the Relative Certainty Problem, CP* must be false since it wrongly entails that E confirms $H2$ in EXPERIMENT. Of course, we could amend CP further, getting:

> **CP**** If E confirms $H1$, and $H1$ entails $H2$, and $H2$ isn't already confirmed as much as it can be by evidence of E's type, then E confirms $H2$.

But such a principle is bound to be problematic; again, it seems rather ad hoc, and it's surely going to be a complex and interest-relative affair to decide which type E counts as a token of (a piece of evidence, a piece of perceptual evidence, a piece of visual evidence, a piece of visual evidence that there's a table and cup in front of me, a piece of evidence collected on a Tuesday?). Perhaps these problems are solvable,[9] but it seems to me that it would be better to have a principle that didn't require us to wade into the complexities of carving up evidence tokens into the appropriate types.

2.2. The Heterogeneous Conjunction Problem

Another problem with CP arises from Nelson Goodman's discussion in *Fact, Fiction, and Forecast*. There, Goodman (1983) was concerned with absurd results that come from combining the CP principle with the principle that hypotheses are confirmed by their logical consequences. For, if we assume that both of these principles are true and if we let $H1$ just be

9. To be fair, there is some reason to think that background information might be able to help determine the relevant type. In the example where the hallucinatory drug only caused visual hallucinations, it's natural to think that the relevant evidence type is **visual evidence** since I know that only visual evidence can be hallucinated in this situation. If the drug had caused all types of sensory hallucination, then it's plausible that the relevant evidence type would be the broader type **sensory evidence**. However, further complexities arise with such an approach that I won't go into here for reasons of space, and I think a better solution to the puzzle is provided by the view that I present below.

the conjunction of E and $H2$, then E confirms $H1$ (since E is a logical consequence of $E \wedge H2$), and $H1$ certainly entails $H2$ (since $E \wedge H2$ entails $H2$), from which it follows by CP that E confirms any $H2$ whatsoever, which is absurd. Call this the **Heterogeneous Conjunction Problem**.

Moreover, it's not at all clear that CP* or CP** can adequately handle this problem. The problem isn't restricted to cases where $p(H2) = 1$, so CP* is of no help; Goodman's problem is just as pressing even if we assume that $p(H2) = .5$, say. As for CP**, it's very difficult here to evaluate the claim that "$H2$ isn't already confirmed as much as it can be by evidence of E's type." Goodman's problem arises because E and $H2$ might have nothing to do with each other, and yet E will always confirm $E \wedge H2$, which entails $H2$. So if E and $H2$ have "nothing to do with each other," is $H2$ confirmed as much as it can be by evidence of E's type? Again, we're going to have difficulties deciding on which type E is a token of. If E is a sentence describing visual evidence that snow is white and $H2$ is "There is an odd number of grains of sand on Daytona Beach," then E certainly seems irrelevant to $H2$. But $H2$ plainly isn't as confirmed as it could be by visual evidence; we clearly could, in principle, collect visual evidence that $H2$ is true. Perhaps CP** could accommodate Goodman's problem in some clever way; for now, all I'm claiming is that it's not *obvious* that CP** helps with Goodman's problem and that we have good reason to be skeptical of CP** anyway.

Goodman's reaction to the Heterogeneous Conjunction Problem is, essentially, to get rid of the principle that hypotheses are always confirmed by their logical consequences. Goodman considers, for example, the conjunction: "8497 is a prime number and the other side of the moon is flat and Elizabeth the First was crowned on a Tuesday." Goodman (1983, 69) then claims that "to show that any one of the three component statements is true is to support the conjunction by reducing the net underdetermined claim. But support of this kind is not confirmation." Thus, though a trusted historian's report that Elizabeth the First was crowned on a Tuesday would support our belief in the conjunction by leaving less underdetermined, Goodman does not want such support to count as confirmation; otherwise, we end up with the result that the historian's report confirms "8497 is prime" since that sentence is entailed by the conjunction. Thus, Goodman's proposal was to restrict the notion of confirmation so as to rule out cases like this where $H1$ is a so-called heterogeneous conjunction.

The trouble with this response is that it is inconsistent with some very modest Bayesian assumptions. Assuming that certain extremely modest conditions are met, it follows from Bayes's Theorem that sentences are always confirmed by their logical consequences. By Bayes's Theorem, $p(A \mid B) = \frac{p(A) \times p(B \mid A)}{p(B)}$. But supposing that A entails B, $p(B \mid A) = 1$, so $p(A \mid B) = \frac{p(A)}{p(B)}$. Thus, assuming that $p(A) > 0$ and $p(B) < 1$ (both *extremely* modest assumptions), it follows that $p(A \mid B) > p(A)$, so B confirms A.[10]

Perhaps Goodman had a different, more intuitive, notion of confirmation in mind, according to which some evidence report E can raise the probability of a hypothesis H without thereby confirming it. But, as I've said, I'm using "confirmation" and "evidence" just to *mean* probability raising, so such an understanding is unavailable to me.

So, if there is an absurd result that comes from conjoining the CP principle with the principle that hypotheses are confirmed by their logical consequences (assuming the modest conditions above are met), then the fault must lie with the CP principle. And, even if Goodman would not have put it quite this way, we can see in Goodman a candidate solution. Rather than restricting the notion of *confirmation* to cases where the putatively confirmed sentence fails to be a heterogeneous conjunction, we might instead restrict *CP* so as to apply *only* to cases where $H1$ fails to be a heterogeneous conjunction. Thus, we have

CP′ If E confirms $H1$, and $H1$ entails $H2$, and $H1$ isn't a heterogeneous conjunction, then E confirms $H2$.

This principle doesn't obviously lead to the result that any E confirms any $H2$; we're not allowed to just let $H1$ be $E \wedge H2$ since $E \wedge H2$ isn't in general a nonheterogeneous conjunction.[11] There is a great deal more to say about this problem and about CP′; in particular, we obviously need a more precise notion of "heterogeneous conjunction" if this is going to be a usable concept, and I'll have more to say about this problem later on.

10. Though H is confirmed by its logical consequences (assuming the modest conditions are met), a different claim in the neighborhood is false—namely, that if E *confirms* $H1$, then E confirms $H1 \wedge H2$. For one thing, E might confirm $H1$ while disconfirming $H2$, in which case it might disconfirm $H1 \wedge H2$. But there are well-known cases (see, for example, Salmon 1975) where E confirms both $H1$ and $H2$ individually but disconfirms the conjunction $H1 \wedge H2$.

11. Of course, $E \wedge H2$ *might* be a nonheterogeneous conjunction. If E = "The left half of the couch is red" and $H2$ = "The right half of the couch is red," then it seems that on any reasonable account of heterogeneity, the conjunction $E \wedge H2$ = "The couch is red" won't be a heterogeneous conjunction.

For the time being, let's just note the problem, the Goodman-inspired solution, and press on.

I claimed above that it's not clear that CP** can handle the Heterogeneous Conjunction Problem. But I think it's even clearer that CP′ can't handle the Certainty Problem or the Relative Certainty Problem. For simplicity, consider again the Certainty Problem: let *E* be "There appears to be a table in front of me," *H*1 be "There is a table in front of me," and *H*2 be the logically true sentence "Either snow is white or snow isn't white." According to CP′, since *E* confirms *H*1 and *H*1 entails *H*2, it follows that *E* confirms *H*2 as long as *H*1 isn't a heterogeneous conjunction. But here, *H*1 is just the hypothesis that there's a table in front of me, and thus is not "heterogeneous," on any natural understanding of heterogeneity. So, to deal with both the Certainty (and Relative Certainty) Problems and the Heterogeneous Conjunction Problem, it seems as though we need some combined principle:

> **CP+** If *E* confirms *H*1, and *H*1 entails *H*2, and *H*2 isn't already confirmed as much as it can be by evidence of *E*'s type, and *H*1 isn't a heterogeneous conjunction, then *E* confirms *H*2.

For all I've said so far, CP+ might be extensionally correct, but it's perhaps worth noting that our CP-like principle is getting rather complex and unmotivated independently of the counterexamples, and that it would be better if we could find some way to handle the Certainty Problem, the Relative Certainty Problem, and the Heterogeneous Conjunction Problem more elegantly with a single modification to CP.

2.3. The Atypical Class Member Problem

The third type of counterexample to CP (and CP+) that I will be concerned with here is the following kind of case:

Marbles

> There is a jar of ten marbles in front of me, five of which were made in Canada and five of which were made in the United States. Of the five marbles made in Canada, four are white and one is red. Of the five marbles made in the United States, all five are red. I am blindfolded, and a friend picks a marble at random from the bag and calls the selected marble "marble X." He tells me that marble X is red; let *E* be "X is red," *H*1 be "X is the (unique) red marble from Canada," and *H*2 be "X is from Canada."

Now, E confirms $H1$; before learning E, $p(H1) = 1/10$, and after learning E, $p(H1 \mid E) = 1/6$. Clearly, $H1$ entails $H2$ since it follows from X's being the unique red marble from Canada that X is from Canada. However, E *disconfirms* $H2$; $p(H2) = 1/2$, whereas $p(H2 \mid E) = 1/6$. Thus, in MARBLES, E confirms $H1$, and $H1$ entails $H2$; however, E actually *disconfirms* $H2$. Call this the **Atypical Class Member Problem**.

Again, it's not at all clear that our previous modifications to CP can deal with the problem. In MARBLES, $H2$ wasn't "certain" before collecting E; $p(H2) = 1/2$. Also, it doesn't seem as though there's any natural sense in which $H2$ was already confirmed as much as it could be by evidence of E's type; we didn't have *any* evidence (beyond the experimental setup) as to the identity of marble X before collecting E. Moreover, supposing that E's type is visual evidence about the color of marble X, $H2$ is decidedly not as confirmed as it could be by evidence of E's type; if we were to learn (before learning E), for example, that marble X is white, then the posterior probability that we assigned to $H2$ would have been 1, which is, of course, higher than 1/2. Finally, the *motivation* behind the "$H2$ isn't already confirmed as much as it can be by evidence of E's type" clause in CP** in response to the Relative Certainty Problem was that E was only neutral to (and didn't confirm) $H2$ because a sufficient amount of evidence of E's type had already been taken into account. But here, E actually *disconfirms* $H2$, so given that E is itself a token of its own type, it follows that in the case above, *not* all of the relevant evidence of E's type had yet been taken into account.

In addition, I don't think it's plausible here that $H1$ is a "heterogeneous conjunction" in Goodman's sense, so it's not clear that CP$'$ or CP+ are of any help. It's true that, given the setup of MARBLES, $H1$ is equivalent to $E \wedge H2$ since there's only one red marble that was made in Canada. But this could easily be changed without disturbing the important features of the case.[12] Also, even if $H1$ is equivalent to $E \wedge H2$, it's not clear that this makes $H1$ a *heterogeneous* conjunction. After all, E and $H2$ are about the same subject matter (unlike in Goodman's case where one conjunct is about Elizabeth the First and the other conjunct is a number-theoretic claim), and the hypothesis that X is the red marble

12. Suppose that, of the five marbles from Canada, three are white, one is red, and one is green and that all five marbles from the United States are red. Let E be "X is red or green," $H1$ be "X is green," and $H2$ be "X is from Canada." E confirms $H1$, $H1$ entails $H2$, and E disconfirms $H2$, but it's not the case here that $H2$ is equivalent to $E \wedge H2$ since there's a red marble from Canada as well as the green one.

from Canada is a perfectly intelligible and nonheterogeneous-*seeming* hypothesis. Again, to know what to say here, we need to hear more about what "heterogeneous" is supposed to mean. In any event, it's certainly far from obvious that CP+ has the resources to handle the Atypical Class Member Problem, so it looks as though we have to modify CP again.

As should be clear from the name I've given to the problem, the distinctive feature of cases like MARBLES seems to be that the red marble from Canada is in some intuitive sense an atypical member of its class. In MARBLES, most of the marbles from Canada are white, and most of the marbles from the United States are red, yet $H1$ is a claim about an atypical (that is, red) marble from Canada. This is what allows the evidence that X is red to confirm the hypothesis that X is the atypical marble from Canada while disconfirming the hypothesis that X is from Canada; the red marble from Canada is not (in respect of color, at least) typical of the class of Canadian marbles in the setup, whereas it is typical of the class of American marbles. So perhaps we need a principle like

CP++ If E confirms $H1$, and $H1$ entails $H2$, and $H2$ isn't already confirmed as much as it can be by evidence of E's type, and $H2$ isn't a heterogeneous conjunction, and $H1$ makes a claim that is about a relevantly typical member of its class, then E confirms $H2$.

But just as with "heterogeneous," there are serious ambiguities here regarding what should count as "typical." Also, just as there are several different evidence types that E will token, there are several different classes that any object referred to in $H1$ will be a member of, and it's not at all clear which is the "relevant" one. We need another approach.

3. Some Attempts at a Solution

It seems that CP and its descendants (CP*, CP**, CP$'$, CP+, and CP++) couldn't be right. What has gone wrong?

In all of the cases above that caused trouble for CP-like principles, E is either neutral to or disconfirms $H2$, so $p(H2 \mid E) \leq p(H2)$. So, if we want to guarantee that E confirms $H2$, all we need to do is require that the condition that $p(H2 \mid E) > p(H2)$ is met.[13] Thus, we have the principle:

13. Of course, by Bayes's Theorem, we could state this condition in terms of likelihoods if we wanted. Bayes's Theorem entails that $p(H2 \mid E) > p(H2)$ iff $p(E \mid H2) > p(E)$, so we could just as easily require that $p(E \mid H2) > p(E)$. But it's not at all clear that that provides any less trivial a condition.

"If E confirms $H1$, and $H1$ entails $H2$, and $p(H2 \mid E) > p(H2)$, then E confirms $H2$." But, of course, this principle is utterly trivial. It's *analytic* that, when $p(H2 \mid E) > p(H2)$, then E confirms $H2$; that's what I'm using "confirms" to *mean*. We want to be able to say *why* it is that evidence *for H1* sometimes constitutes evidence for $H2$ and sometimes doesn't, and we want a *usable* principle that can guide our practice of CP-like reasoning. In both regards, this principle disappoints.

We can do a bit better. Since $H1$ entails $H2$, it follows that $H1$, $\neg H2$, and $\neg H1 \wedge H2$ are pairwise inconsistent and jointly exhaustive. Thus, it follows that if E confirms $H1$ and disconfirms $H2$ (that is, confirms $\neg H2$), then E must disconfirm $\neg H1 \wedge H2$.[14] Thus, assuming that E confirms $H1$, it follows that if E confirms or is neutral to $\neg H1 \wedge H2$, then E confirms $H2$. So, the condition that $p(\neg H1 \wedge H2 \mid E) \geq p(\neg H1 \wedge H2)$ will be adequate to ensure that E confirms $H2$.[15] Notice that this condition fails, for example, in MARBLES, where E fails to confirm $H2$; there, $p(\neg H1 \wedge H2) = 4/10$ and $p(\neg H1 \wedge H2 \mid E) = 0$.

However, I don't think that this condition is particularly informative either. To determine whether $p(\neg H1 \wedge H2 \mid E) \geq p(\neg H1 \wedge H2)$, we need to already know something about what effect E has on $H2$ (more specifically, on the conjunction of $H2$ with $\neg H1$), and the point of having a usable CP-like principle seems to be to be able to say, *without already knowing the probabilistic effect that E has on* $H2$, whether the reason that E provides to become more confident in $H1$ also constitutes a reason to become more confident in $H2$. It seems as though we sometimes acquire E, notice that it confirms $H1$, and then raise our confidence in $H2$ on that basis, *without directly considering the question of whether E confirms* $H2$. So, we don't want the condition that we supplement CP with to require us

14. The converse is not true since E might confirm $H1$, disconfirm $\neg H1 \wedge H2$, and yet also disconfirm $\neg H2$ (that is, confirm $H2$). So we can actually say a bit more than this. Since $H1$, $\neg H2$, and $\neg H1 \wedge H2$ exhaust the logical space, it follows that $\Delta p(H1) + \Delta p(\neg H2) + \Delta p(\neg H1 \wedge H2) = 0$. In order for $H2$ to be confirmed, $\Delta p(\neg H2) < 0$. Thus, $H2$ is confirmed just in case $\Delta p(H1) + \Delta p(\neg H1 \wedge H2) > 0$. Or, more explicitly, just in case $p(H1 \mid E) - p(H1) + p(\neg H1 \wedge H2 \mid E) - p(\neg H1 \wedge H2) > 0$. In more intuitive terms, $H2$ is confirmed by E just in case the positive change in $H2$'s probability caused by E is greater than the negative change in $\neg H1 \wedge H2$'s probability caused by E. So, whenever E confirms $H1$ and also confirms $\neg H1 \wedge H2$, it follows that E confirms $H2$.

15. This condition is sufficient but not necessary for E to confirm $H2$. E can confirm $H1$, disconfirm $\neg H1 \wedge H2$, and still confirm $H2$. See note 14 for elaboration. I don't actually think this is a weakness in the condition, though, as will become clear below.

to conditionalize $H2$ (or any conjunction containing $H2$) on E; clearly, the condition under consideration does require us to do this. Thus, this condition isn't really much better than the condition that $p(H2 \mid E) > p(H2)$. In either case, we need to look at the complete probability distributions before and after conditionalizing on E in order to figure out whether E confirms $H2$. The only difference is that determining whether the first condition holds requires us to look directly at $H2$ before and after conditionalizing, whereas determining whether the second condition holds requires us to look at $\neg H1 \wedge H2$ before and after conditionalizing.

So, if we're going to have a principle of the sort I'm suggesting, we need to avoid any term in which "$H2$" appears to the left of the conditionalization bar and "E" appears to the right. As a first stab, I think it's worth noticing that in Marbles, though the evidence confirmed $H1$, it didn't confirm $H1$ *that much*; in that case, $p(H1) = 1/10$ and $p(H1 \mid E) = 1/6$. A natural thought, then, is that we might try requiring that $p(H1 \mid E)$ be higher—say, higher than $p(\neg H1 \mid E)$.[16] This condition clearly fails in Marbles. Moreover, this condition clearly does not require us to conditionalize $H2$ (or any molecular sentence containing $H2$) on E.

The trouble is that $p(H1 \mid E) > p(\neg H1 \mid E)$ doesn't actually provide a sufficient condition for E to confirm $H2$. The reason is that if $H2$ was already very likely before conditionalizing on the evidence, it's possible that $p(H1 \mid E) > p(\neg H1 \mid E)$ and yet that E still disconfirms $H2$. For example, suppose as before that there is a bag of marbles in front of you with ninety marbles made in Canada and ten made in the United States. Of the ninety Canadian marbles, eighty-eight are white and two are red; of the ten American marbles, nine are white and one is red. Again, someone chooses one marble at random and calls it "X." Let E be "X is red," $H1$ be "X is one of the Canadian red marbles," and $H2$ be "X is from Canada." Here, E certainly confirms $H1$; before learning E, $p(H1) = 2/100$, whereas after learning E, $p(H1 \mid E) = 2/3$. Also, $H1$ obviously entails $H2$. Further, $p(H1 \mid E) > p(\neg H1 \mid E)$ since $p(H1 \mid E) = 2/3$ and $p(\neg H1 \mid E) = 1/3$. Yet, still, E disconfirms $H2$; $p(H2) = 90/100$ and $p(H2 \mid E) = 2/3$. Moreover, notice that no straightforward strengthen-

16. Recall that I'm using the relevance notion of confirmation here, so the claim that E makes $H1$ more likely than $\neg H1$ isn't redundant of the claim that E confirms $H1$ (as it would be if I were using an absolute notion of confirmation with a "threshold" over $1/2$). If $p(H1) = .2$ and $p(H1 \mid E) = .3$, for example, then E confirms $H1$ (in the relevance sense) even though E doesn't make $H1$ more likely than $\neg H1$.

ing of the requirement that $p(H1 \mid E)$ be adequately high (say, that $p(H1 \mid E) > 2 \times p\ (\neg H1 \mid E)$, or that $p(H1 \mid E) > .99$) is going to help here since we can always make the prior probability of $H2$ high enough (by increasing the prior probability of $\neg H1 \wedge H2$) so that $H2$ may fail to be confirmed by E.

For a similar reason, we're not going to be able to characterize the conditions under which E confirms $H2$ by specifying the likelihoods $p(E \mid H1)$, $p(E \mid \neg H2)$, and $p(E \mid \neg H1 \wedge H2)$ alone. The trouble is that we can come up with pairs of cases such that the likelihoods are *identical*, but in one case E confirms $H2$ (as well as confirming $H1$), and in the other case E disconfirms $H2$ (while confirming $H1$).[17] This is accomplished precisely by changing the prior probability of $\neg H1 \wedge H2$ (and thus of both $H1$ and $H2$). Example:

> **Case A** There is a bag with ninety-two Canadian marbles and eight American marbles. Of the ninety-two Canadian marbles, ninety are white and two are red. Of the eight American marbles, seven are white and one is red. One marble is chosen and called "X." Let E be "X is red," $H1$ be "X is one of the red marbles from Canada," and $H2$ be "X is from Canada." $p(H1) = 2/100$, $p(H1 \mid E) = 2/3$, $p(H2) = 92/100$, and $p(H2 \mid E) = 2/3$, so E confirms $H1$, $H1$ entails $H2$, but E disconfirms $H2$.

> **Case B** Same as case A, except that now there are only eight Canadian marbles—six white and two red. (There are eight American marbles, seven white and one red, as before.) Let E, $H1$, and $H2$ be defined as in case A. Here, $p(H1) = 2/16$, $p(H1 \mid E) = 2/3$, $p(H2) = 1/2$, and $p(H2 \mid E) = 2/3$, so E confirms *both* $H1$ *and* $H2$.

However, notice that the likelihoods $p(E \mid H1)$, $p(E \mid \neg H2)$, and $p(E \mid \neg H1 \wedge H2)$ are identical in case A and case B; in both cases, $p(E \mid H1) = 1$, $p(E \mid \neg H2) = 1/8$, and $p(E \mid \neg H1 \wedge H2) = 0$.[18]

17. Besides, it's not at all clear that having to consider quantities like $p(E \mid \neg H1 \wedge H2)$ and $p(E \mid \neg H2)$ is better than having to consider quantities like $p(H2 \mid E)$. We want to be able to state a usable condition that *doesn't* require us to explicitly consider the probabilistic effect that E has on $H2$ (or any conjunction containing $H2$), or vice versa.

18. Of course, not *all* of the likelihoods are the same in case A and case B; in particular, $p(E \mid H2) = 2/92$ for case A and $p(E \mid H2) = 2/8$ for case B. But having to consider $p(E \mid H2)$ isn't any better than having to consider $p(H2 \mid E)$, especially given the theorem that $p(H2 \mid E) > p(H2)$ iff $p(E \mid H2) > p(E)$; by this theorem, determining whether $H2$ confirms E is equivalent to determining whether E confirms $H2$. So there is some hope for the likelihood approach, although I'm very skeptical that we'll be able to state any interesting, illuminating, and elegant CP-like principle in terms of the likelihoods alone.

4. The Dragging Condition

Where are we? We are trying to find a supplementary condition that, when added to CP, will yield a nontrivial and usable principle characterizing the conditions under which, when E confirms $H1$, E will also confirm the entailed $H2$. We don't want this condition to contain any term in which $H2$ (or any molecular sentence containing $H2$) is conditionalized on E, else we will have to directly consider E's effect on $H2$ in order to determine whether E confirms $H2$, defeating the purpose of a CP-like principle. At the end of the last section, we saw that placing some constraint either on $p(H1 \mid E)$ alone or on the likelihoods $p(E \mid H1)$, $p(E \mid \neg H2)$, and $p(E \mid \neg H1 \wedge H2)$ alone wouldn't help since the priors $p(H1)$ and $p(H2)$ could always be manipulated so that E fails to confirm $H2$. This, I think, gives us some reason to expect that one or both of the priors—$p(H1)$ and $p(H2)$—will appear in our supplementary condition. We also, I think, have reason to expect that $H1$, $H2$, and E will *all* appear in the condition since the relation under discussion looks to be three-place: the reason that E provides to become more confident in $H1$ also constitutes a reason to become more confident in $H2$.

Here's what I propose: $p(H2) < p(H1 \mid E)$. I call this the **DRAGGING CONDITION**. The intuitive rationale for the DRAGGING CONDITION is clear enough; if E raises the probability of $H1$ to some value v, then all of the logical entailments of $H1$ that had a prior probability lower than v get confirmed (since their posterior probability conditional on E must be at least v) as their probabilities get "dragged" up by $H1$. The reason for this, obviously, is that it's not rational to have a lower credence in one of $H1$'s entailments than in $H1$ itself.

From the DRAGGING CONDITION, it follows that $p(H2) < p(H2 \mid E)$ (since $H1$ entails $H2$, obviously $p(H1 \mid E) \leq p(H2 \mid E)$, so $p(H2) < p(H2 \mid E)$ by transitivity), and thus that $H2$ is confirmed by E. It is easy enough to see that the reverse entailment does not hold, even on the assumption that E confirms $H1$; $p(H2) < p(H2 \mid E)$ can hold even when it's not the case that $p(H2) < p(H1 \mid E)$. Example: Suppose a bag has ten marbles from Canada—four white marbles, four red marbles, and two green marbles—as well as ten marbles from the United States, all ten of which are white. One marble is chosen and called "X." Let E be "X is red or green," $H1$ be "X is green," and $H2$ be "X is from Canada." Here, $p(H1) = 2/20$ and $p(H1 \mid E) = 1/3$, so E certainly confirms $H1$. And $H1$ clearly entails $H2$. And, E confirms $H2$ as well since $p(H2) = 1/2$ and

$p(H2 \mid E) = 1$. But, here, it's not true that $p(H2) < p(H1 \mid E)$; $p(H2) = 1/2$ and $p(H1 \mid E) = 1/3$.

So, the DRAGGING CONDITION is a stronger condition than $p(H2) < p(H2 \mid E)$, even when it is assumed that E confirms $H1$. I claim merely that the DRAGGING CONDITION is a *sufficient* condition for E to confirm $H2$, not a necessary condition. This is crucial. Indeed, the example above demonstrates that it couldn't be a necessary condition. If you want a *necessary and sufficient* condition for E to confirm $H2$, you'll have to be satisfied with the trivial condition mentioned above that $p(H2) < p(H2 \mid E)$;[19] in other words, you'll just have to look at the probability distributions before and after conditionalizing on E and determine directly whether E confirms $H2$. If you are happy with a merely sufficient condition but one that is informative and usable in a wide range of cases of actual reasoning, I recommend the DRAGGING CONDITION.

Here's why you should be satisfied with the merely sufficient condition that I suggest, rather than insisting on a *necessary and* sufficient condition for E to confirm $H2$. When we're using CP-like reasoning and we're deliberating about whether the evidence that E provides for $H1$ also constitutes evidence for $H2$, we're wondering whether E provides evidence for $H2$ *in virtue of confirming* $H1$. Otherwise, giving the E-$H1$-$H2$ argument implicit in an instance of CP would be *entirely beside the point*, for we could just give a more direct E-$H2$ argument, ignoring $H1$ entirely. Even without the foregoing discussion, it should be clear that there are going to be some cases in which E does confirm $H2$, but in which E's confirmation of $H1$ isn't *alone* adequate to *guarantee* that E confirms $H2$; in other words, there are going to be cases in which the fact that E confirms $H2$ depends on E confirming $H2$ *directly*—that is, *independently of confirming* $H1$. Consider the following two cases:

> **Case C** We have decent evidence that the murder was an inside job, and we assign a probability of .50 to $H2$ = "Someone on the mansion staff did it." There are five equally suspicious members of the mansion staff, including the butler, so we assign a probability of .10 to $H1$ = "The butler did it." We learn E = "The killer's DNA sequence is S." The butler's DNA sequence is S, so E dramatically confirms $H1$; let's suppose that $p(H1 \mid E) = .99$. Obviously, $p(H2 \mid E)$ is approximately .99 as well.

19. Or, not much better, the conditions referred to in notes 13 and 14.

Case D Same setup as in case C, except that this time, we learn $E =$ "The killer's shoe size is 10." The butler's shoe size is 10, so E confirms $H1$ (though obviously less dramatically than in case C); let's suppose that $p(H1 \mid E) = .15$. However, we don't know whether E confirms $H2$ until we find out the shoe sizes of the other mansion employees. Suppose that, after looking into it, we find out that the other four mansion employees also have size 10 shoes, so that E does confirm $H2$; suppose $p(H2 \mid E) = .75$.

I take it to be fairly natural to characterize the difference between case C and case D as a difference in whether E confirms $H2$ primarily in virtue of confirming $H1$ (as in case C) or directly (as in case D).[20] Actually, matters aren't quite that simple, for two reasons. First, since we're assuming through all of this that E confirms $H1$, there's always going to be a *component* of E's effect on $H2$ that goes via $H1$. Second, whether or not E's confirmation of $H1$ is enough all by itself to guarantee that E confirms $H2$ is going to turn on the particular values that we assign to the priors and posteriors of $H1$ and $H2$, even in case D (which I claimed to be a case of primarily direct confirmation). I'll have more to say about both of these points below. However, for now, all I want to do is motivate the idea that we should be looking only for a sufficient condition and not a necessary condition to supplement CP with. The reason is that cases with the E-$H1$-$H2$ structure where E confirms $H2$ *in virtue of confirming* $H1$ form a more limited class than do cases where E confirms $H2$ with no such qualification, and I'm claiming that when we use CP-like reasoning, we're tacitly assuming that E doesn't merely confirm $H2$ but confirms $H2$ in virtue of confirming $H1$. Otherwise, a CP-like principle would be of no use to us.

Let me try to make all of that a bit more precise. Since we're assuming here that $H1$ entails $H2$, it follows that $p(H1 \mid E) + p(\neg H2 \mid E) + p(\neg H1 \wedge H2 \mid E) = 1$. Thus, $p(H1 \mid E) + p(\neg H1 \wedge H2 \mid E) = p(H2 \mid E)$. We saw that the trivial necessary (and sufficient) condition for E to confirm $H2$ was that $p(H2) < p(H2 \mid E)$. So, the trivial condition is equivalent to $p(H2) < p(H1 \mid E) + p(\neg H1 \wedge H2 \mid E)$. The Dragging Condition is stronger; it says that $p(H2) < p(H1 \mid E)$. Call $p(\neg H1 \wedge H2 \mid E)$ the **direct component relative to *H*1** of E's effect on $H2$.[21] Call $p(H1 \mid E)$ the **via-*H*1 component** of E's effect on $H2$. When the Dragging

20. Directly *relative to* $H1$, that is.

21. When it's clear, I will drop the "relative to $H1$."

CONDITION is met, the via-$H1$ component of E's effect on $H2$ is enough *all by itself* to guarantee that E confirms $H2$, and I will say that E confirms $H2$ in virtue of confirming $H1$. Thus, regardless of the value of the direct component of E's effect on $H2$, we know that E will confirm $H2$.

Of course, it's perfectly consistent with the DRAGGING CONDITION that the direct component of E's effect on $H2$ (that is, $p(\neg H1 \wedge H2 \mid E)$) is nonzero. It's even perfectly consistent with the DRAGGING CONDITION that $p(\neg H1 \wedge H2 \mid E) > p(H2)$, in which case the direct component of E's effect on $H2$ is *also* sufficient, all by *itself*, to guarantee that E confirms $H2$. So, on this account, direct confirmation and confirmation in virtue of $H1$ are perfectly compatible. Satisfaction of the DRAGGING CONDITION ensures that, in order to determine whether E confirms $H2$, *we don't have to consider* the direct component of E's effect on $H2$. When we use CP-like reasoning, being forced to consider the direct component of E's effect on $H2$ is precisely what we are trying to avoid. It's not that we're assuming without evidence that the direct component of E's effect on $H2$ is small; it's just that, when we use CP-like reasoning, we *don't care* what its value is. We want to know whether to increase our confidence in $H2$ *on the basis of E's confirmation of* $H1$, and the DRAGGING CONDITION tells us that we can do so.

Here's one final (slightly different) way to see what's going on here. Since we're assuming that E confirms $H1$,[22] we know that $p(H1) < p(H1 \mid E)$. And since $H1$ entails $H2$, we know that $p(H1 \mid E) \leq p(H2 \mid E)$. So, $p(H1) < p(H1 \mid E) \leq p(H2 \mid E)$. Now, where does $p(H2)$ fit into this inequality? Well, since $H1$ entails $H2$, we know that $p(H1) \leq p(H2)$. If $p(H1) \leq p(H2) < p(H1 \mid E) \leq p(H2 \mid E)$, then the DRAGGING CONDITION is met, and the via-$H1$ component of E's effect on $H2$ is sufficient to guarantee that E confirms $H2$ (even though $H2$ might *also* be confirmed by E directly). If $p(H1) < p(H1 \mid E) \leq p(H2) \leq p(H2 \mid E)$, then $H2$ is confirmed by E but was not guaranteed to be confirmed by E simply in

22. I said that the DRAGGING CONDITION (that is, $p(H2) < p(H1 \mid E)$) is the condition under which E confirms $H2$ in virtue of confirming $H1$. So, this condition entails that E in fact does confirm $H1$; this is obvious because $p(H1) \leq p(H2)$ (since $H1$ entails $H2$), so $p(H1) < p(H1 \mid E)$. This is because we're *assuming* that E confirms $H1$. If you want the weaker condition under which *if E confirms* $H1$, *then* E confirms $H2$ in virtue of confirming $H1$, it is provided by the disjunction $(p(H1 \mid E) < p(H1)) \vee (p(H1 \mid E) > p(H2))$. A natural way of putting this in pseudo-English is "$p(H1 \mid E)$ does not have a value in between $p(H1)$ and $p(H2)$."

virtue of the via-$H1$ component of E's effect on $H2$. And, if $p(H1) < p(H1 \mid E) \leq p(H2 \mid E) \leq p(H2)$, then $H2$ is not confirmed by E, either directly or via $H1$. These options are clearly exhaustive.

So, the DRAGGING CONDITION is only a sufficient, and not a necessary, condition for the evidence that E provides for $H1$ to also constitute evidence for $H2$ since E confirms $H2$ when $p(H1) < p(H1 \mid E) < p(H2) \leq p(H2 \mid E)$ even though the DRAGGING CONDITION isn't met. But we should expect cases where we reason using the E-$H1$-$H2$ structure—where we come to increase our confidence *in H1* on the basis of E and only come to *thereby* increase our confidence in $H2$ on the basis of the entailment *from H1* to $H2$—to correspond to a proper subclass of the cases where E confirms $H2$. My claim is that the DRAGGING CONDITION specifies that proper subclass.

5. Back to the Three Problems with CP

In this section, I'll argue that the DRAGGING CONDITION provides a nice account of, and solution to, the three related problems for CP that I discussed above—the Certainty (and Relative Certainty) Problem, the Heterogeneous Conjunction Problem, and the Atypical Class Member Problem. To address all three problems, we need only make a single modification to CP, yielding the

> **Confirmation of Dragged Consequences (CDC) Principle** If E confirms $H1$, $H1$ entails $H2$, and the DRAGGING CONDITION obtains, then E confirms $H2$.[23]

As a referee from this journal points out to me, there is the following potential concern about my argumentative strategy: if (as I have been assuming) p is a classical probability function, then CDC is a provable *theorem*; indeed, I proved CDC in the previous section. Thus, the thought continues, we can be assured, even before looking carefully back through the counterexamples to CP, that there couldn't possibly be any counterexamples of *any* sort to CDC. But if that's right, then what possible interest could there be in going back through the particular problems I

23. Actually, on the assumption that $H1$ entails $H2$, the DRAGGING CONDITION entails that E confirms $H1$, so we could actually formulate CDC more compactly as "If $H1$ entails $H2$ and the DRAGGING CONDITION obtains, then E confirms $H2$." I leave "If E confirms $H1$" in the antecedent of CDC to make it clear precisely how it amends CP.

identified with CP and showing how they're not problems for CDC as well (which is precisely what I propose to do in this section)?

The best answer I can give is that I'm trying to put forward the following picture: CP seems plausible because it seems as though reasonable inferences that we make every day are justified by CP. But it turns out that, on a very natural Bayesian understanding of evidence, CP is false. I'm suggesting that, even though CP is false on that Bayesian understanding, CDC is weaker but true (indeed: provably true) on that understanding, and moreover that it's similar enough to CP to justify all of the everyday reasonable inferences that we started with. Indeed, I think that CDC is the *minimal* weakening of CP that we need to do all of the work that CP could do, while also avoiding CP's counterexamples. And as we'll see, in several of the counterexamples to CP, the DRAGGING CONDITION just *barely* fails to be satisfied—that is, because $p(H2) = p(H1 \mid E)$. So, the interest in going back through the counterexamples to CP is that, in each case, I hope to give a diagnosis of the nature of the counterexample to CP, to show not just *that* CDC avoids the counterexample but also *how* and *why* it does, and to motivate the thought that CDC is the minimal deviation from CP that we're looking for. Of course, if you are interested only in whether CDC has probabilistic counterexamples, its "theoremhood" should satisfy you that it does not, and you should skip to section 6 to see what philosophical use I put CDC to.

So, let's see how CDC handles our three problems.

5.1. The Certainty and Relative Certainty Problems

It's fairly obvious how CDC handles the Certainty Problem. If, before considering E, I already assigned a credence of 1 to $H2$, then of course $p(H2) = 1$. But if $p(H2) = 1$, then it's impossible that $p(H2) < p(H1 \mid E)$ since the upper bound for classical probabilities is the value 1. Thus, CDC does not entail that E will confirm those logical consequences of $H1$ that are already confirmed to degree 1, and the Certainty Problem is solved.

As for the Relative Certainty Problem, the solution is similar, though a bit more complicated. Recall EXPERIMENT above, when I find myself in a room and have yet to open my eyes. Since I know that nineteen of the twenty subjects were placed in a room with real objects, I assign a prior credence of .95 to $H2$ ("I'm in a room with other objects"). The prior credence that I assign to $H1$ ("I'm in a room with a lamp and a cup") is fairly low since the experimenters didn't specify that it would be *those* objects that nineteen of us would be placed in a room with. So let's say that $p(H1) = .095$ (say, because I think that there's a 10 percent chance that a room with objects contains a lamp and a cup). When I open my eyes and seem to see a lamp and a cup, this obviously confirms $H1$. What is the value of $p(H1 \mid E)$? Well, by Bayes's Theorem, $p(H1 \mid E) = \frac{p(H1)\times p(E \mid H1)}{p(H1)\times p(E \mid H1)+p(\neg H2)\times p(E \mid \neg H2)+p(\neg H1 \wedge H2)\times p(E \mid \neg H1 \wedge H2)}$. We know that $p(H1) = .095$, and we know that $p(E \mid H1) = 1$ since I'm certain to seem to see a lamp and a cup if I really am in a room with a lamp and a cup (assuming my eyes are working properly and I'm facing in the right direction). What about the denominator? Well, I assumed above that there was a 10 percent chance that a room with other objects contained a lamp and cup. For parity,[24] let's assume that there's a 10 percent chance that a hallucination of objects will be a hallucination of a lamp and a cup. Thus, $p(E \mid \neg H2) = .10$ since if I'm not in a room with other objects, then I'm the one who was given the hallucinatory drug, in which case the probability is .10 that I'll have an experience as of a lamp and a cup. As for $p(E \mid \neg H1 \wedge H2)$, this term will have value 0; given the experimental setup, if I'm in a room with other objects that do not include a lamp and a cup, then I wasn't given the hallucinatory drug, and so I won't have an experience as of a lamp and a cup. Thus, $p(H1 \mid E) = \frac{(.095)(1)}{(.095)(1)+(.05)(.10)+0} = \frac{.095}{.1} = .95$. Thus, since $p(H2) = .95$, $p(H2) = p(H1 \mid E)$, so it's not the case that $p(H2) < p(H1 \mid E)$, so the Dragging Condition fails.

Even without the foregoing calculations, though, it should be clear that $p(H1 \mid E)$ can't have a value higher than $p(H2)$ in the case under consideration. Before opening my eyes, I'm 95 percent sure that I'm in a room with other objects and 5 percent sure that I'm in an empty room but under the influence of a hallucinatory drug. Either way, I know that I'm about to have an experience as of some objects, and the experience I in fact have as of a lamp and a cup doesn't give me any further information relevant to whether I'm the one who was given the drug. So, after having that experience, how can my confidence that I'm in a room with a lamp and a cup be any higher than .95? It seems like $p(H1 \mid E)$ must *precisely equal* .95. If I'm really in a room with other objects, I'm as confident as I can be that I'm in a room with a lamp and a cup. But I'm only 95 percent sure that I'm in a room with other objects, and thus only 95 percent sure that I'm in a room with a lamp and a cup, so the Dragging Condition fails.

24. Otherwise, my experience as of a lamp and a cup will favor one hypothesis or the other about whether I'm the subject who was given the drug, which we don't want.

5.2. *The Heterogeneous Conjunction Problem*

Next, consider the Goodman-inspired Heterogeneous Conjunction Problem. Let E be "The moon is flat," $H1$ be "The moon is flat and Elizabeth I was crowned on a Tuesday," and $H2$ be "Elizabeth I was crowned on a Tuesday." Goodman's worry was that if we say that E confirms $H1$ because it "leaves less underdetermined," then it follows from CP that E confirms $H2$, which is absurd. I argued above that it follows from some quite modest Bayesian assumptions that E confirms $H1$ here, so that the problem must be with CP. But now it's easy to see how CDC succeeds where CP failed. In the case under consideration, $H1 = E \wedge H2$. The DRAGGING CONDITION, $p(H2) < p(H1 \mid E)$, will thus hold iff $p(H2) < p(E \wedge H2 \mid E)$, which will hold iff $p(H2) < \frac{p(E \wedge H2 \wedge E)}{p(E)}$, which will hold iff $p(H2) < \frac{p(E \wedge H2)}{p(E)}$, which will hold iff $p(E) \times p(H2) < p(E \wedge H2)$. And, of course, since the flatness of the moon and the day of Elizabeth I's crowning are probabilistically independent, $p(E) \times p(H2) = p(E \wedge H2)$, so it's not the case that $p(E) \times p(H2) < p(E \wedge H2)$. So, the DRAGGING CONDITION fails. Thus, using the DRAGGING CONDITION, we can specify what is wrong with Goodman's "heterogeneous conjunction" cases in purely probabilistic terms, without having to take on the difficult and almost surely hopeless task of providing an account of heterogeneity (in terms of natural kinds, or class membership, or whatever).[25]

5.3. *The Atypical Class Member Problem*

The final problem with CP discussed above is the Atypical Class Member Problem. Recall MARBLES from above. In that case, $p(H1) = 1/10$, $p(H2) = 1/2$, $p(H1 \mid E) = 1/6$, and $p(H2 \mid E) = 1/6$, so E confirms $H1$ but disconfirms $H2$. But it is easy to see that the DRAGGING CONDITION is not met in MARBLES; it is not the case that $p(H2) < p(H1 \mid E)$.

The same is true in other instances of the Atypical Class Member problem. Jim Pryor (2004, 350–51) offers another example of this problem:

> Suppose you start with its being 80 percent likely for you that Clio's pet is a dog. Then you're informed that Clio's pet has no hair. One effect of this information is to raise the likelihood that her pet is an American Hairless Terrier, which hypothesis *entails* that it's a dog. But the information also

25. Following Hempel, Goodman pursues something like this approach in Goodman 1983.

> *decreases* the total likelihood that Clio's pet is a dog. It makes it more likely that she owns a fish or a bird. So: evidence can give you more justification to believe P than you had before, you can know P to entail Q, and yet your evidence make you less justified in believing Q than you were before.

Though Pryor doesn't himself offer any diagnosis of this case, it's fairly clear that the Dragging Condition isn't satisfied in Pryor's case. Let E be "Clio's pet has no hair," $H1$ be "Clio's pet is an American Hairless Terrier," and $H2$ be "Clio's pet is a dog." We are told that $p(H2) = .80$, and it's natural to assume that $p(H1)$ has a much lower value than .80, given that American Hairless Terriers are somewhat rare dogs. So let's suppose that $p(H1) = .05$. When we learn E, E confirms $H1$ but not to *that* high a degree since (as Pryor points out) it's more likely given that evidence that Clio owns a fish or a bird. Certainly, $p(H1 \mid E)$ is lower than .80, so the Dragging Condition fails.

In addition to solving the Atypical Class Member Problem, CDC also provides an *explanation* of why E fails to confirm $H2$ in instances of the Atypical Class Member Problem. In Marbles, the red marble from Canada is (in respect of color) atypical of marbles from Canada in that it is red and the other four marbles from Canada are white. What's more, the red marble from Canada is (in respect of color) quite typical of a class it's not a member of—namely, marbles from the United States—since all five of the American marbles are red. Thus, when we learn that the chosen marble is red, $p(H1 \mid E)$ isn't that high since most of the red marbles are American; in Marbles, $p(H1 \mid E) = 1/6$. So the question is whether $p(H2) < 1/6$. Of course, in Marbles, $p(H2) = 1/2$, so the Dragging Condition fails. We could try to reduce $p(H2)$—say, by changing the example so that there are fewer than five Canadian marbles in the bag. But even if we removed all four white Canadian marbles, $p(H2)$ would equal 1/6 (and $p(H1 \mid E)$ would still equal 1/6). So, since the red marble from Canada is atypical of Canadian marbles and typical of American marbles, the lower limit for $p(H2)$ is $p(H1 \mid E)$, from which it follows that the Dragging Condition won't be met. Of course, all of this talk of class membership is highly imprecise, and I don't mean for any real conceptual weight to be borne by it; the precise account of the phenomenon is given by CDC. The only point I'm making is that, in addition to solving the Atypical Class Member Problem, the Dragging Condition provides an explanation of how the Atypical Class Member Problem arose in the first place.

Thus, CDC handles the Certainty (and Relative Certainty) Problems, the Heterogeneous Conjunction Problem, and the Atypical Class Member Problem all with a single simple modification to CP. Moreover, in addition to being extensionally correct, I think that CDC provides a nice *account* of these problems. For each problem, we are able to give an explanation of *why* and *how* the conditions distinctive of that problem conspire to prevent the DRAGGING CONDITION from being satisfied. Finally, using the Dragging Condition, CDC states the conditions under which the evidence that E provides for $H1$ also constitutes evidence for $H2$ in *purely probabilistic* terms. As a result, the solution that CDC gives to the problems we've encountered is quite general.

6. Transmission-Failure

Recently, Crispin Wright (2000, 2002, 2003, 2004), Martin Davies (2003, 2004), Jim Pryor (2004, 2011, forthcoming), and others have discussed the putative phenomenon of *warrant transmission-failure*, where, it is claimed, though some piece of evidence E provides an epistemic warrant for some claim $H1$, and though $H1$ logically entails $H2$, still the warrant that E provides for $H1$ does not "transmit" through the logical entailment from $H1$ to $H2$. Wright's diagnosis of the phenomenon is that E's warrant for $H1$ fails to transmit to $H2$ in these situations because E provides warrant for $H1$ only if the subject has *independent* warrant for $H2$; thus, E cannot provide a *new* reason to believe $H2$. In particular, Wright claims that G. E. Moore's famous "proof" of an external world, conceived of as follows, exhibits warrant transmission-failure and therefore cannot give anyone a *new* warrant for the belief that there is an external world:

MOORE

E: My experience is as of a hand in front of me.
$H1$: There is a hand in front of me.
$H2$: There is an external world.

These sorts of cases look to be relevant to CP-like principles; if there are genuine cases of transmission-failure as that phenomenon is understood by Wright, then these cases threaten to provide further counterexamples to CP. For instance, in MOORE, any nonskeptic would agree that E confirms $H1$, and it's obvious that $H1$ entails $H2$. But insofar as it's plausible that E fails to confirm $H2$, we look to have a counterexample to CP that isn't obviously addressed by any of CP, CP*, CP**, CP$'$, CP+, or CP++. In this section, I will argue that CDC provides a natural account of the central cases in the transmission-failure literature.

First, let me note one point of difference between the issue as Wright and Davies discuss it, on the one hand, and, on the other, as I'll be discussing it. Wright's explicit concern is with whether the *warrant* that E provides for $H1$ transmits to $H2$, where warrant is understood to be some sort of all-things-considered justificatory state. My focus in this essay has been on *confirmation*, where the fact that E confirms H isn't understood to entail that all-out belief in H is *epistemically appropriate* or *mandated* or even *permitted* for a subject once he or she has acquired E. On my view (which I can't defend here), the most fundamental epistemic questions are ones about confirmation rather than all-things-considered states like *being justified in believing P* or *having a warrant for P.* In any event, the cases that have occupied philosophers writing on transmission-failure are just as challenging and interesting when they're understood as putative cases where *evidence* or *confirmation* fail to transmit as when they're understood as cases where *warrant* fails to transmit. And it would be a mark in CDC's favor if it can handle these cases.

One thing that we obviously want from an account of transmission-failure is the ability to distinguish arguments that exhibit transmission-success from arguments that exhibit transmission-failure. Here is a relatively uncontroversial case of transmission-success:

Zebra

E: My experience is as of a zebra in a pen in front of me.
$H1$: There is a zebra in a pen in front of me.
$H2$: There is an animal in a pen in front of me.

It's pretty clear that **Zebra** exhibits transmission-success, at least in most ordinary cases; it's very plausible that it's reasonable for me to become quite confident (perhaps for the first time) that there is an animal in a pen in front of me when I seem to see a zebra there, and something like the Zebra argument seems to be the right way to model my reasoning. Wright, Davies, Pryor, and every other writer on transmission-failure of whom I am aware agree.

What does CDC have to say about Zebra? Well, if I didn't previously have any reason to think that there's an animal in a pen in front of me, then my $p(H2)$ is quite low—say, .01. And, unless I have some reason to suspect an elaborate trick of some sort, $p(H1 \mid E)$ is reasonably high; certainly most of us would become quite confident that there is a zebra in a pen in front of us if we were to have an experience as of a zebra in a pen in front of us. So it's clear that $p(H2) < p(H1 \mid E)$, so the DRAGGING CONDITION is met, so CDC correctly entails that E confirms $H2$.

Now consider:

ZEBRA*

E: My experience is as of a zebra in a pen in front of me.
$H1$: There is a zebra in a pen in front of me.
$H2$: It's not the case that there's a mule cleverly disguised to look like a zebra in a pen in front of me.

I think it's fairly clear that ZEBRA* exhibits transmission-failure; unlike in ZEBRA, it seems patently *unreasonable* to increase your confidence in $H2$ on the basis of an argument like ZEBRA*. Most authors of whom I am aware concur in this verdict.[26] What does CDC say about ZEBRA*? It's fairly clear that $p(H1 \mid E)$ will be high in ZEBRA*, just as in ZEBRA; barring some reason to suspect an elaborate trick, a visual experience as of a zebra in a pen is excellent evidence that there is a zebra in a pen. But it should also be clear that whereas $p(H2)$ was quite low in ZEBRA, $p(H2)$ is quite high in ZEBRA*. Before having the visual experience as of zebra, my confidence that there is a cleverly disguised mule in a pen in front of me is presumably quite low (what reason could I have to believe *that*?), and so my confidence that there is *not* a cleverly disguised mule in a pen in front of me is quite high.

So both $p(H1 \mid E)$ and $p(H2)$ are high, but in order to know whether the DRAGGING CONDITION obtains, we obviously need to know which is *higher*. In a recent paper, Roger White (2006) has pointed out that, in arguments like ZEBRA*, $\neg H2$ entails E (perhaps with the help of some suitable background premises), and that it's an elementary result of probability theory (which we encountered in section 2.2) that, if X entails E, then E confirms X (assuming that $p(E) < 1$ and that $p(X) > 0$). So if $\neg H2$ entails E, then E confirms $\neg H2$. But if E confirms $\neg H2$, then E disconfirms $H2$. And if E disconfirms $H2$, then the DRAGGING CONDITION can't

26. One notable exception is Tucker 2010. Pryor thinks that MOORE exhibits transmission-success and that whether or not ZEBRA* exhibits transmission-success turns on the question of whether the proposition that there is a zebra in a pen in front of me is a "perceptually basic content" (see Pryor 2000). Pryor isn't fully explicit about which contents are perceptually basic; if it turns out that the proposition that there is a zebra in a pen in front of me is not a perceptually basic content, then Pryor agrees with this verdict as well.

possibly be met since the DRAGGING CONDITION is a sufficient condition for E to confirm $H2$. So the DRAGGING CONDITION must fail, and so $p(H2)$ must be higher than $p(H1 \mid E)$. So CDC doesn't entail that E confirms $H2$ in ZEBRA*, which is precisely the result that we want.

And in fact, we don't even need the assumption that $\neg H2$ entails E in order to show that the DRAGGING CONDITION can't be satisfied in cases like ZEBRA*. For the crucial feature of ZEBRA* that, I think, is most responsible for the intuition that it exhibits transmission-failure is the condition that $p(E \mid H1) = p(E \mid \neg H2)$. In other words, I'm just as likely to have an experience as of a zebra in a pen in front of me if there is a zebra in a pen in front of me as I am if there's a cleverly disguised mule in a pen in front of me. After all, the natural thought goes, how could a zebra-ish experience be evidence *for* the hypothesis that there is a zebra in front of me but evidence *against* the hypothesis that there is a cleverly disguised mule in front of me if I'm just as likely to have that zebra-ish experience regardless of which hypothesis is true?

A consequence of the condition that $p(E \mid H1) = p(E \mid \neg H2)$ (together with Bayes's Theorem) is that $\frac{p(H1 \mid E)}{p(\neg H2 \mid E)} = \frac{p(H1)}{p(\neg H2)}$; in other words, the ratio of the posterior probabilities of $H1$ and $\neg H2$ is the same as the ratio of the prior probabilities.[27] What are reasonable values for $p(H1)$ and $p(\neg H2)$ in ZEBRA*? As indicated before, $p(H1)$ should be quite low – .004, say. But however plausible it is (before having a zebra-ish experience) that there is a zebra in a pen in front of me, it's presumably even less plausible that there's a cleverly disguised mule in a pen in front of me, so $p(\neg H2)$ should be even lower – .002, say. If $\frac{p(H1)}{p(\neg H2)} = \frac{.004}{.002} = 2$, it follows that $\frac{p(H1 \mid E)}{p(\neg H2 \mid E)} = 2$, so $p(\neg H2 \mid E) = \frac{p(H1 \mid E)}{2}$. Since $H1$ entails $H2$, $H1$ and $\neg H2$ are incompatible, so $p(H1 \mid E) + p(\neg H2 \mid E) \leq 1$, so $\frac{3p(H1 \mid E)}{2} \leq 1$, so $p(H1 \mid E) \leq .6667$. Thus, since $p(H2) = .998$, $p(H2) > p(H1 \mid E)$, so the DRAGGING CONDITION fails to be satisfied.

In fact, it's a provable result of the condition that $p(E \mid H1) \leq p(E \mid \neg H2)$ that the DRAGGING CONDITION can *never* be satisfied, even if $\neg H2$ fails to entail E (that is, even if $p(E \mid \neg H2) \neq 1$).

27. This is a trivial consequence of Bayes's Theorem. $p(H1 \mid E) = \frac{p(H1) \times p(E \mid H1)}{p(E)}$ and $p(\neg H2 \mid E) = \frac{p(\neg H2) \times p(E \mid \neg H2)}{p(E)}$. Since the evidence is precisely the same in each case, $p(E)$ cancels out of the ratio, and since $p(E \mid H1) = p(E \mid \neg H2)$, these terms cancel out as well.

PROOF

Suppose that $p(E \mid H1) \leq p(E \mid \neg H2)$.
By Bayes's Theorem, $\frac{p(H1 \mid E)}{p(\neg H2 \mid E)} = \frac{p(H1) \times p(E \mid H1)}{p(\neg H2) \times p(E \mid \neg H2)}$.
Since $p(E \mid H1) \leq p(E \mid \neg H2)$, $\frac{p(E \mid H1)}{p(E \mid \neg H2)} \leq 1$.
So $\frac{p(H1 \mid E)}{p(\neg H2 \mid E)} \leq \frac{p(H1)}{p(\neg H2)}$.
Suppose for *reductio* that the DRAGGING CONDITION is met.
So $p(H1 \mid E) > p(H1)$ and $p(H2 \mid E) > p(H2)$.
So $p(\neg H2 \mid E) < p(\neg H2)$.
So $\frac{p(H1 \mid E)}{p(\neg H2 \mid E)} > \frac{p(H1)}{p(\neg H2)}$.
Contradiction.
So, it's not the case that the DRAGGING CONDITION is met.

This result is independent of which particular values we assign to $p(H1)$ and to $p(\neg H2)$; even if I were in a situation where I took it to be antecedently (that is, before having the zebra experience) *more* likely that there's a cleverly disguised mule in a pen in front of me than that there's a zebra in a pen in front of me (so that $p(H1) < p(\neg H2)$), the DRAGGING CONDITION still couldn't be met. So even if I *did* have reason to believe that there were a lot of cleverly disguised mules in the area, nothing about my analysis of ZEBRA* would change. And this seems like the right result; the intuition that ZEBRA* exhibits transmission-failure is the intuition that ZEBRA* isn't a way to become more confident that there isn't a cleverly disguised mule in a pen in front of me, regardless of whether there happen to be any (or even many) cleverly disguised mules in my vicinity (and regardless of whether I know that there are).

If my analysis of ZEBRA* is correct, then it must be similarly impossible for the DRAGGING CONDITION to be satisfied in RED:

RED

E: It seems to me that there is a red wall in front of me.
$H1$: There is a red wall in front of me.
$H2$: It's not the case that there's a white wall in front of me that is white but lit by red lighting.

In RED, I'm presumably just as likely to have an experience as of a red wall if the wall is actually red as I am to have that experience if the wall is white but lit by red lighting, so $p(E \mid H1) = p(E \mid \neg H2)$, so PROOF above shows that the DRAGGING CONDITION can't be satisfied in RED either. Jim Pryor

(2004) has defended the transmission-success of RED on the grounds that it exhibits only a "type-4" dependency, where the justification we have for the premises requires us only to *lack* justification for believing that the conclusion is *false*, rather than a "type-5" dependency, where the justification we have for the argument's premises requires us to have antecedent (that is, epistemologically prior) justification for believing that the conclusion is true. Though Pryor agrees that arguments with type-5 dependencies exhibit transmission-failure, he thinks that arguments with only type-4 dependencies exhibit transmission-success. But on my account, this distinction between type-4 and type-5 dependencies is entirely beside the point. RED, just like ZEBRA*, can't ever be used to acquire a new reason to believe the relevant $H2$.

In my view, even though the DRAGGING CONDITION is only a sufficient condition for E to confirm $H2$, the DRAGGING CONDITION is a *necessary and* sufficient condition for transmission of confirmation. In other words, I think that intuitions about the transmission-success of an E-$H1$-$H2$ argument are really just intuitions about whether E confirms $H2$ *in virtue of confirming* $H1$ in that argument, and I've already argued that the DRAGGING CONDITION is a necessary and sufficient condition for E to confirm $H2$ in virtue of confirming $H1$. So I think that the DRAGGING CONDITION does a nice job not only of sorting arguments into those that exhibit transmission-success and those that exhibit transmission-failure, but also of explaining why it is that we have the intuition of transmission-failure in arguments that fail to satisfy the DRAGGING CONDITION.

7. Bootstrapping

In recent years, the complaint has been made (among others, by Stewart Cohen [2002], Richard Fumerton [1995, 178–79], and Jonathan Vogel [2000, 615]) that epistemological theories with a certain structure permit an illegitimate sort of "bootstrapping," whereby a subject can gain justification to believe that one of his or her faculties is reliable simply by relying on that very faculty. I think that this complaint is legitimate, and I am unpersuaded by attempts to address it (see, for example, Kung 2010; Pryor 2004, 2011; and Weatherson 2007). In this section, I will argue that the DRAGGING CONDITION provides an account of why bootstrapping is indeed illegitimate and of why theories with the structure that Cohen identifies permit it.

Call a view according to which a subject S can acquire justification to believe p on the basis of faculty F, even if he or she doesn't have any antecedent reason to believe that F is reliable, a **LIBERAL VIEW ABOUT F**. Justification-reliabilism about vision, for example, is a liberal view about vision; according to the reliabilist, I can gain justification to believe that there is a table in front of me by using my visual faculty, even if I don't have any antecedent reason to believe that my vision is reliable. Of course, the reliabilist doesn't say that *any* belief of mine formed on the basis of vision must be justified; such a belief wouldn't be justified if my vision were in fact *un*reliable. But the important point is that, according to the reliabilist, it's *possible* for me to acquire justification to believe that there's a table in front of me, even if I lack reason to believe that my vision is reliable.

Dogmatism about vision is another liberal view about perception. According to dogmatism, when I have a perceptual experience with the content that p, it is required that I *lack* a reason to believe that my perceptual faculty is *unreliable* in order for me to acquire justification to believe p (see, for example, Pryor 2000, 2004). But my *lacking* a reason to believe that my perceptual faculty is unreliable doesn't entail my *having* a reason to believe that my vision is reliable,[28] and dogmatism entails that it's *not* required that I *have* a justification to believe that my perceptual faculty *is* reliable in order to acquire justification to believe p. Thus, dogmatism counts as another liberal view, though one that is very different from reliabilism.

Now, the bootstrapping objection against dogmatism runs as follows: Suppose that dogmatism is true. Imagine that you have a stack of colored cards in front of you. You pick up the first card, and it seems red to you, so you form the introspective belief that the card seems red to you. And suppose that you have no reason to suspect that your vision is unreliable; thus, according to dogmatism, you'll also be justified in believing that the card is red. So, putting the two beliefs together, you're justified in believing that the card is red and it seems red to you.[29] So you're justified in believing that your vision was accurate in this case. By repeating this process with other cards, you can get strong inductive evidence that your color vision is reliable (after all, how else could your color vision keep getting the card colors right?). But that's absurd; you can't get reason to

28. Compare: that I lack a reason to believe that the coin is going to land heads doesn't entail that I have a reason to believe that it will land tails; perhaps I believe that the coin is fair, or have no idea what its bias is.

29. Here we use the principle that if you're justified in believing A and also justified in believing B, then you're justified in believing the conjunction $A \wedge B$. Preface-style worries aside, this principle is fairly uncontroversial in this context.

think that your vision is reliable from your vision alone, unchecked by any independent source. So dogmatism is false. It should be clear that the same sort of objection could be run against any liberal view about any faculty.

A possible response that the dogmatist could offer here is that *every* reasonable epistemological view allows for bootstrapping (see White 2006 for discussion), so that the objection considered above can't count specifically against dogmatism. To see how this response would go, suppose as before that you don't have any antecedent reason to believe that your color vision is unreliable. The dogmatist thinks that, in this situation, the card's appearing red to you justifies you in believing that the card is red. A nondogmatist will deny this, but even the nondogmatist should concede that the card's appearing red to you is *some* evidence that the card is red. After all, you have no reason to believe that your vision is unreliable, so you shouldn't discount its deliverances entirely, even if you don't have any reason to think that it is reliable. Thus, the card's appearing red to you should make you more confident that the card is red than that it is (say) yellow, even if it shouldn't make you *all that* confident that the card is red. So even the nondogmatist thinks that you get some evidence that the card is red from the red appearance. And, presumably, the nondogmatist will accept that you have excellent (perhaps even indefeasible) introspective evidence that the card seems red to you. Putting the two together, you've gotten some evidence that the card seems red to you and is in fact red. In other words, you've gotten some evidence that your vision got the color of this card right, even if you're not justified in fully believing that your vision got it right. And even some evidence that you got it right should give you some evidence that your vision is reliable after all, especially if you "test" your vision with several cards. But again, this is no way to get evidence that your vision is reliable. So even the nondogmatist faces a bootstrapping problem, so there must be something wrong with the bootstrapping objection to begin with.

But the bootstrapping problem isn't a problem for the nonliberal, and the DRAGGING CONDITION explains why. Suppose that there are ten equiprobable card colors, and that I'm about to select one card at random. Let APPEARSRED be "The card appears red." Let RED be "The card is red." Let NOERROR be "The card is actually the color it appears to be." Since there are ten equiprobable card colors, before looking at the card, my $p(\text{RED}) = .1$. And my $p(\text{APPEARSRED}) = .1$ too.

What about my $p(\text{APPEARSRED} \wedge \text{RED})$? That depends on my estimate of my reliability in making color judgments. Suppose that I'm justified in taking myself to have 40 percent reliability when it comes to making color judgments, in the sense that when a card is a particular color, there's a probability of .4 that it will appear that color to me (and a probability of .6/9 that it will appear to be any particular one of the nine other colors). So, my p(APPEARSRED$\wedge$RED) $= (.1)(.4) = .04$.

But my p(NOERROR) will be significantly higher since NOERROR is weaker than APPEARSRED$\wedge$RED; the former but not the latter is consistent with the card's being yellow and appearing yellow, for example. Since I take myself to be 40 percent reliable at getting card colors correct, my p(NOERROR) $= .4$.

Now, suppose that I have a visual experience as of a red card, and my credence in APPEARSRED goes to 1. My credence in RED goes to .4. And my credence in APPEARSRED$\wedge$RED goes to .4 as well.

We now have a familiar setup:

BOOTSTRAPPING

E: APPEARSRED
$H1$: APPEARSRED$\wedge$RED
$H2$: NOERROR

It's clear that E confirms $H1$ since p(APPEARSRED$\wedge$RED) $= .04$ and p(APPEARSRED$\wedge$RED | APPEARSRED) $= .4$. And it's clear that $H1$ entails $H2$. Should we conclude on this basis that E confirms $H2$ as well? In this case, the DRAGGING CONDITION is satisfied just in case p(NOERROR) $<$ p(APPEARSRED$\wedge$RED | APPEARSRED). And since both sides of the inequality equal .4, the DRAGGING CONDITION fails. So we have a bootstrapping problem here only if we accept CP, which I have argued that we should not. Once you reject CP in favor of CDC, the bootstrapping problem is avoided. So bootstrapping isn't a problem for the nonliberal, as long as he or she rejects CP.

8. Objections and Replies

Objection 1: When the DRAGGING CONDITION is met, we'll only *sometimes* have a reason to increase our confidence in $H2$. As Harman has repeatedly pointed out (see, for example, Harman 1988, 1999), even if we know that p entails q, a reason to believe p is only sometimes a reason to believe q. After all, the realization that the p entails a q that we have reason to *disbelieve* will sometimes defeat our reason to believe p. In such a case, we'll end up with reason to believe neither p nor q, rather than reason to believe both. For example, reasons to believe the axioms of naive set theory aren't reasons to believe in contradictions once we realize that since the axioms of naive set theory are inconsistent, they entail contradictions. Instead, the fact that the axioms of naive set theory entail contradictions (which we have independent reason to disbelieve) is a reason not to believe the axioms of naive set theory (and perhaps to look for axioms that aren't inconsistent). Translating all of this into the language of evidence and partial belief, it might be that I originally take E to be evidence for $H1$, and since $H1$ entails $H2$ and (let's suppose) the DRAGGING CONDITION is met, I also take E to be evidence for $H2$. But if I have strong independent reason to disbelieve $H2$, the realization that $H1$ entails $H2$ might justify pessimism about whether E really is evidence for $H1$ after all, rather than optimism about whether E really is evidence for $H2$ after all. The DRAGGING CONDITION seems to countenance only the optimistic response, while completely ignoring the pessimistic response that is surely sometimes rational.

Reply: To begin with, I've been assuming throughout my discussion that the entailment from $H1$ to $H2$ is *recognized* by the agent and that the relevance of this entailment is *fully appreciated*. In doing so, I've completely sidestepped a well-known objection to Bayesian approaches to epistemology, namely, the so-called Problem of Logical Omniscience (see, for example, Earman 1992 and Howson and Urbach 1993 for discussion). I don't know the best way to model logical nonomniscience, but, as far as I can tell, nobody else does either. (Again, see Earman 1992 and Howson and Urbach 1993 for discussion. See also Hacking 1967.) Moreover, it's quite standard in discussions of closure-like principles in the epistemology literature to simply ignore complications that arise from logical nonomniscience. Clearly, if we do ignore the issue of logical nonomniscience, then this objection goes away; it is premised on the possibility of an agent thinking that E is evidence for $H1$, but then coming to rationally question that once he or she *realizes* that $H1$ entails some $H2$ that he or she has independent reason to disbelieve. If the agent is logically omniscient (or, at least, logically omniscient with respect to $H1$), then his or her $p(H1 \mid E)$ will not be higher than his or her $p(H2)$ when he or she has good reason to keep his or her credence in $H2$ low; instead, his or her $p(H1 \mid E)$ will be bounded from above by his or her $p(H2)$, preventing the DRAGGING CONDITION from being satisfied. At the very least, we can say that satisfaction of the DRAGGING CONDITION mandates *either* a subject's increase in his or her confidence in $H2$ *or* a reevaluation of his or her $p(H1 \mid E)$. I suspect that this story can be supplemented with whatever the right thing to say about Harman's point is in general;

again, I seem to be in the same boat here with almost every other writer on closure-like principles.

Objection 2: Surely, we sometimes get "transmitted" evidence for $H2$ even though the DRAGGING CONDITION isn't met. Some new evidence for $H1$ is prima facie evidence for $H2$ too. Of course, as you point out, there are cases when this prima facie evidence for $H2$ isn't all-things-considered evidence for $H2$. But that doesn't mean that we're always irrational in taking evidence for $H1$ to be evidence for $H2$ even when the DRAGGING CONDITION isn't satisfied. Suppose that your confidence that the butler did it is .2 and that your confidence that someone on the mansion staff did it is .9. Some new evidence that somewhat incriminates the butler might motivate you to increase your credence that the butler did it from .2 to .3. And, prima facie, that's reason to increase your confidence that someone on the mansion staff did it from .9 to some higher number. But the DRAGGING CONDITION clearly isn't met here; $p(H2) = .9$ and $p(H1 \mid E) = .3$.

Reply: As I've already argued in section 4, it will sometimes be the case that $p(H2 \mid E) > p(H2)$ even when the DRAGGING CONDITION isn't met. Indeed, as argued in note 14, this will happen precisely when $p(H1 \mid E) - p(H1) + p(\neg H1 \wedge H2 \mid E) - p(\neg H1 \wedge H2) > 0$—in other words, if and only if either (a) E has a nonnegative impact on $\neg H1 \wedge H2$, or (b) E has a negative impact on $\neg H1 \wedge H2$ but one that is linearly smaller than E's positive impact on $H1$. So, I agree that if an agent has reason to believe that either (a) or (b) is met, then he or she will be justified in increasing his or her confidence in $H2$ even if the DRAGGING CONDITION isn't met. Perhaps what is motivating this objection is the idea that the agent has some reason to be confident that (a) or (b) is met in the butler case—that is, some reason to believe that E is either positively relevant or not particularly negatively relevant to the proposition that someone on the mansion staff other than the butler did it. But I do not agree that "having no opinion" on the issue of what evidential impact E has on the proposition that someone on the mansion staff other than the butler did it is sufficient to justify the agent in increasing his or her confidence in $H2$ on the basis of E; after all, if he or she has no opinion on a matter the resolution of which might well make increasing his or her credence in $H2$ inappropriate, it seems irrational for him or her to go ahead and "blindly" increase his or her credence in $H2$ anyway. The DRAGGING CONDITION specifies the condition under which such a move isn't "blind" even if the agent doesn't have an explicit view about the evidential impact that E has on $\neg H1 \wedge H2$.

Objection 3: Consider the following argument:

NOSE

E: It seems to me that there is a table in front of me.
$H1$: There is a table in front of me and I have a nose.
$H2$: There is a table in front of me.

Suppose that I'm (nearly) certain that I have a nose. And suppose that I'm in a situation where I wasn't already confident for independent reasons that there's a table in front of me, so that my $p(H2)$ is low. Assuming that I have no special reason to doubt my senses on this occasion, my p (There is a table in front of me $|E$) will be high. And since I'm (nearly) certain throughout that I have a nose (and since I regard my having a nose to be completely independent of the locations of tables), my $p(H1 \mid E)$ is high. So the DRAGGING CONDITION is easily satisfied. And, indeed, E is evidence for $H2$, so $p(H2 \mid E) > p(H2)$. But it's certainly not in virtue of an argument like NOSE that E is evidence for $H2$. The proposition that I have a nose (or any conjunctive proposition featuring the proposition that I have a nose as a conjunct) is completely irrelevant to the evidence that E provides for $H2$. It is controversial what the correct epistemology of perception is,[30] but it is uncontroversial that beliefs about noses don't in general play a crucial role.[31]

Reply: I agree that there is something odd about NOSE, and I agree that it's odd to say that E is evidence for $H2$ in virtue of being evidence for $H1$; if anything, E looks to be evidence for $H1$ in virtue of being evidence for $H2$ (together with E's irrelevance to the proposition that I have a nose). But it is a delicate matter to characterize the *kind* of oddness that arguments like NOSE exhibit.

Suppose that I see on television that the barometric pressure is falling. Though I know that this is a reliable indicator of rain in the near future, I don't end up forming the belief that it is going to rain soon (perhaps the phone rings and I get distracted before getting around to forming this belief). A few minutes later, reflecting on the falling barometric pressure, I think of my friend Lucy. Lucy's moods reliably covary with the barometric pressure (when the pressure is rising, Lucy is happy, and when the pressure is falling, Lucy is sad), and I know this. Moreover,

30. And, of course, there's nothing special about perception here; it is easy to construct a case like NOSE where E is nonperceptual evidence for $H2$.

31. Thanks to Stephen Schiffer for pressing me on a slightly different version of this objection.

because of the correlation between falling barometric pressure and rain in the near future, Lucy's moods also reliably covary with whether it is going to rain soon (when it's going to rain soon, Lucy is sad, and when it's not going to rain soon, Lucy is happy). Knowing that the barometric pressure is falling, I form the justified belief that Lucy is sad. And then, knowing that Lucy's sadness correlates with rain, I form the justified belief that it's going to rain soon.

In this case, there's nothing defective about my reasoning. Of course, I failed to form the belief that it's going to rain directly on the basis of evidence that justified that belief (namely, the falling barometric pressure), but we often fail to form beliefs that are justified by our evidence for all sorts of reasons (such as getting distracted, not caring, and so on). My evidence that the barometric pressure is falling really is evidence that Lucy is sad, and my evidence that Lucy is sad really is evidence that it's going to rain. Now, you might still think that there's something *odd* about my reasoning; it seems unnecessarily circuitous since, given that I know that falling barometric pressure is evidence for rain, I would be able to form the justified belief that it is going to rain on the basis of the television report even if I had never heard of Lucy and knew nothing about her moods. But I don't see any reason to think that the circuitousness of my inference does anything to impugn the justificatory status of the belief that I form as a result of that inference.

Similarly, in NOSE, there's something odd about the inference from E to $H1$ to $H2$, but I don't see any reason to think that this oddness impugns the justificatory status of the argument. Imagine Anne who, as a psychological matter, just can't help adding the conjunct "and I have a nose" (for which she has ample justification) to any claim that she acquires evidence for. So Anne sees a table and immediately forms the belief "There is a table and I have a nose" and can only then step back and see that that belief (if the DRAGGING CONDITION is satisfied) motivates an increase in credence in the claim that there is a table. Should Anne be faulted for increasing her credence that there is a table in this manner? It seems to me that she should not. Her visual evidence really does justify her in becoming more confident in $H1$ than she was antecedently in $H2$, and that realization makes her increase in credence in $H2$ perfectly in order.

Objection 3, part 2: Hold on a second. Earlier in the essay, you motivated the DRAGGING CONDITION by appealing to the notion of E's being evidence for $H2$ *in virtue of* being evidence for $H1$, and you suggested that the DRAGGING CONDITION specifies those cases in which

E is evidence for $H2$ in virtue of being evidence for $H1$. But even if there's nothing epistemically defective about Anne's increase in credence in $H2$ in NOSE—that is, even if Anne is justified by her (strange) inference in becoming more confident in $H2$—still we shouldn't say that E is evidence for $H2$ in virtue of being evidence for $H1$. Anne's inference does not match the "real flow" of evidence, and as a result even if E is evidence for $H2$, it's not in virtue of its being evidence for $H1$.

Reply, part 2: A full response here would take us beyond the scope of this essay, but I am skeptical of putative phenomena like "flow" of evidence and suspect that these phenomena really just come down to which inferences we happen to find most natural or useful. To anyone with Bayesian sensibilities, talk of evidential "flow" from one proposition to another looks like nonsense; a Bayesian update on some evidence motivates a simultaneous change in credences that the agent assigns to every proposition. My own suspicion is that talk of evidential "flow" is a remnant of a syntactic approach to evidence that has faced serious problems since Goodman's seminal *Fact, Fiction, and Forecast*. Of course, we nonideal Bayesian agents don't really update on evidence "all at once," and it takes some nontrivial work to figure out the consequences of updating on some new evidence. CDC is supposed to be a principle that we can use here, when we know that E has some positive evidential relevance to $H1$ but haven't yet worked out what relevance E has to $H2$. Insofar as CDC and other similar principles "leave out" putative phenomena like evidential flow, my view is that there are no real justificatory phenomena to be captured. But again, this isn't a view that I have space to adequately defend here. I hope to pursue this project in future work.

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