# THE CONVERSE-CONSEQUENCE CONDITION

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Carl Hempel critically discusses a number of proposed necessary conditions for an adequate theory of confirmation in his well-known "Studies in the Logic of Confirmation."[1] Among the proposals is the so-called "converse-consequence condition," which Hempel rejects because he thinks it allows for the confirmation of any hypothesis by any evidence whatsoever. Baruch Brody, however, defends the converse-consequence condition, arguing that one cannot simply drop it, that it can be dropped only if one replaces it with some condition that often entails the same thing, and that adoption of the converse-consequence condition sheds much light on the process of qualitative confirmation.[2] I shall take Hempel's side in this dispute by arguing that Brody does not show the necessity or desirability of adopting the converse-consequence condition.

The point of a theory of confirmation is to specify those conditions under which a given body of evidence confirms, disconfirms, or is irrelevant to a given hypothesis. Hempel and Brody both try to develop theories of *qualitative* confirmation, which means that the theory does not tell us anything about the degree to which a hypothesis is confirmed or disconfirmed, if at all. The converse-consequence condition is

> If some evidence *E* confirms a hypothesis *H*, then *E* confirms every hypothesis that entails *H*.

Our question is whether that condition is necessary for any adequate theory of confirmation.

Hempel argues that the answer is "no" along the following lines. Suppose that *E* confirms *H*. Consider any other hypothesis *I*, no matter how irrelevant. Now *H* and *I* entail *H*. Thus, if the converse-consequence condition is true, *E* confirms *H* and *I*. But if all evidence that confirms a hypothesis also confirms the logical consequences of that hypothesis, then *E* also confirms *I*, since *H* and *I* entail *I*. Therefore, any evidence would confirm any hypothesis whatsoever if the converse-consequence condition were true (SLC, p. 32). Although the special-consequence condition is under dispute, and Hempel unmistakably appeals to it in the argument above, we can agree that *E* does not confirm *H and I* if *E* is irrelevant to *I*. And the consequence that *E* confirms *H* and *I* is deducible from the converse-consequence condition alone. Do any of Brody's arguments override Hempel's formidable objection?

Brody argues, first of all, that there are many perfectly acceptable



scientific inferences that are justified if one's theory of confirmation includes the converse-consequence condition, and provides two examples (C&E, pp. 411-12). Evidence for Boyle's law is evidence for the Boyle-Charles law if one adopts the converse-consequence condition. Secondly, evidence for the law of definite proportions also corroborates the atomic theory if the converse-consequence condition is accepted. In both cases the converse-consequence condition is a *sufficient* condition for those inferences.

Brody's conclusion, however, is considerably stronger than his premises, since he says that the validity of the usual inferences whereby evidence for one law is indirect evidence for other laws can plausibly be understood as *depending upon* a theory of confirmation satisfying the converse-consequence condition (C&E, p. 412). Here, Brody might be taken to be saying that the converse-consequence condition is a necessary condition for such inferences, since it is natural to read 'depending upon' as 'requiring', especially since the expressed intention is to defend the view that the converse-consequence condition or a condition that has the same implications must be included in an adequate theory of confirmation. But if this interpretation is correct, then the argument is a non-sequitur, since it involves the inference to 'The converse-consequence condition is *necessary* for the validity of such inferences' from 'The converse-consequence condition is *sufficient* for the validity of such inferences.'

Perhaps this interpretation is unfair, since Brody says that the converse-consequence condition *can plausibly be understood* as being a necessary condition for the validity of such inferences. That is to say less than what is attributed to him in the criticism. I concede the point, but still believe that the argument is vulnerable to criticism. For to say that the converse-consequence condition can *plausibly* be understood as being necessary for those inferences is to assert that the premises constitute some evidence for the conclusion 'The converse-consequence condition is necessary for such inferences'. But since the only premise is 'The converse-consequence condition is sufficient for such inferences', no reason is given for thinking that those inference patterns are not licensed by principles other than the converse-consequence condition. Thus, the argument does not provide a good reason for adopting the converse-consequence condition. I believe that there is another way to account for such inferences, as I shall show presently. But we should take a closer look at the examples used to illustrate those patterns of inference.

In the first place, it is *not* legitimate to infer 'Evidence *E* confirms the conjunction of Boyles' law and Charles' law' from the premise '*E* confirms Boyle's law.' Since Boyle's law states "at constant temperature a fixed weight of gas occupies a volume inversely proportional to the pressure exerted on it,"[3] we could test it in the following manner. Place some gas in a cylinder with a movable piston. Measure the pressure exerted on the gas and the volume of the gas. Triple, say, the pressure on the gas. If the volume of the gas is one-third of our first measurement, then we have corroborating evidence for Boyle's law.

A test of Charles' law would be different, for it states "at *constant* pressure, the volume occupied by a fixed weight of gas is directly proportional to the absolute temperature" (C, pp. 135-36). In order to test *this* law, the pressure must remain *constant*. But in order to test Boyle's law, the pressure must be *varied*. Furthermore, whereas the temperature must remain *constant* in order to test Boyle's law, it must be *varied* in order to test Charles' law. Evidence for one of these laws, then, is not evidence for the conjunction of the two. Since the example misrepresents acceptable scientific practice, it provides no motivation for adopting the converse-consequence condition.

Although Brody is referring to the conjunction of Boyle's and Charles' law when he writes "the Boyle-Charles law" (C&E, p. 422), let us consider a modification of Brody's example, the more complicated case of the ideal gas law, which is derived from Boyle's law and a transformation of the equation expressing Charles' law in terms of the Kelvin scale. But a glance at how the ideal gas law is confirmed shows that it does not support the case for the converse-consequence condition. Confirmation of the ideal gas law requires a *two*-step process, evidence for Boyle's law being pertinent at only the first stage.[4] And the *only* reason why evidence for Boyle's law is regarded as evidence relevant to the ideal gas law is that there is *independent* reason to believe Charles' law, the remaining content of the ideal gas law. This independent evidence for Charles' law, rather than the converse-consequence condition, justifies regarding evidence for Boyle's law as partially corroborative of the ideal gas law.

Lest anyone doubt that such independent reason is required, it should be pointed out that the converse-consequence condition would license the inference from Boyle's law to what I shall call the *anti*-ideal gas law. My anti-ideal gas law will consist of the conjunction of Boyle's law and what I shall call the anti-Charles law, according to which the volume of a gas is *inversely* proportional to the absolute temperature (at constant pressure). Charles' law tells us that the volume of a gas increases as the temperature rises, whereas the anti-Charles law tells us that the volume of a gas decreases as the temperature rises. Let $A$ stand for the anti-ideal gas law, whereas $B$ and not-$C$ stand for Boyle's law and the anti-Charles law, respectively. Suppose that $A$ implies $B$ and not-$C$. If we have some evidence that confirms $B$, then that evidence would confirm $A$, the anti-ideal gas law, if the converse-consequence condition were true. The converse-consequence condition simply lets in too much.

Brody refers us, secondly, to the relationship between Dalton's atomic



theory and the law of definite proportions in defense of the converse-consequence condition. Now Dalton's atomic theory *explains why* the law of definite proportions is true (C, pp. 24-25). But it is not clear that the converse-consequence condition is needed in order to understand why evidence for the law of definite proportions is regarded as evidence for the atomic theory, unless "explaining why" is identified with "logically implying." Later in his article, Brody rightly notes that there are cases where a hypothesis (or theory) explains another hypothesis without logically implying it, for example, the case in which the explain*ing* hypothesis is satistical and makes the explained hypothesis highly likely (C&E, p. 424). It is not that Brody contradicts himself on this score. Rather, he abandons the converse-consequence condition altogether at the end of his article without, I believe, recognizing it. Let us set this aside for the time being, reserving further comment for the conclusion of this paper.

Let us suppose that the atomic theory logically implies the law of definite proportions or, more generally, that there are cases in which evidence for a hypothesis also confirms another hypothesis (or set of hypotheses) that logically implies it. Do such cases require inclusion of the converse-consequence condition in one's theory of confirmation? I do not think so. I think that there is an alternative way of accounting for such inferences.

Consider two laws, $A$ and $B$, and assume that evidence for $B$ also confirms $A$. How would scientists know that the evidence corroborates $A$ as well? They would know only because they had checked the facts of the matter. That is, they understand the meaning of $A$, recognize that the evidence is relevant to $A$, and that it confirms $A$. That is, scientists would know that the evidence also confirms $A$ only if they had checked the relationship between the evidence and $A$ just as they had investigated the relationship between the evidence and $B$. We saw that such independent testing was required in order to account for inferences from evidence for Boyle's law to the ideal gas law. Let us suppose we have the ideal case, where any evidence that confirms $B$ also confirms $A$. If this is so, we may infer in a fresh case where we have evidence for $B$ that we have evidence for $A$ without appealing to the converse-consequence condition, as follows:

1. Evidence $E$ confirms $B$;
2. Any evidence that confirms $B$ also confirms $A$;
3. Therefore, $E$ confirms $A$.

To be sure, the ideal case described in premise 2 is rare, indeed. I have cited the ideal case because the topic is qualitative confirmation, the theory of which provides no information about the degree to which a hypothesis is confirmed. Apart from ideal cases where all or no evidence that confirms one hypothesis confirms another, quantitative notions have to be taken into consideration.

It will not do, of course, to leave premise 2 unchecked in new situations. The trouble with the converse-consequence condition is that it licenses the inference from '*B* is confirmed' to '*A* and *B* are confirmed' without testing for the confirmation of *A* by the evidence, a problem that I haved tried to avoid with the restrictions on the inference pattern I have suggested. There is a moral to this story. If an inference rule that comes close to arguments employing the converse-consequence condition without using it runs its risks, that is all the more reason for avoiding the converse-consequence condition.

It might be thought that the inference pattern I have suggested as a replacement presupposes the consequence condition, against which important objections have been raised.[5] The consequence condition is that if some evidence confirms every one of a class *K* of sentences, then it also confirms any sentence which is a logical consequence of *K* (SLC, p. 31). Rather than argue the merits of the consequence condition, I merely wish to point out that the replacement for the converse-consequence condition that I have proposed does not presuppose the consequence condition. Even if *B* is, *ex hypothesi*, a logical consequence of *A*, the inference pattern I recommend requires independent checks for the corroboration of *B* by the evidence in most cases. That is, it is not *because B* is a logical consequence of *A* that my suggestion licenses the inference to '*E* corroborates *A*.' It is because of the independent checks. If the inference pattern I have suggested involved an appeal to the consequence condition, the argument would be as follows:

1. Evidence *E* confirms *B*;
2. *B* implies *A*;
3. Therefore, *E* confirms *A*.

But we have supposed that *A* implies *B*, not that *B* implies *A*. To draw the logical consequences of premises in an argument *about* confirmation, then, is not the same as presupposing the consequence condition of confirmation.

There are other matters to be considered. Brody asks us to "consider the process whereby experimental evidence confirms theoretical statements" (C&E, p. 412), thereby introducing his second argument. Noting that philosophers have had difficulties in obtaining a theoretical understanding of the confirmation of theoretical hypotheses by experimental evidence, Brody adds that the problem is solved if the converse-consequence condition is satisfied by one's theory of confirmation.

> A very plausible way of understanding this process is to suppose that experimental evidence directly confirms observation laws, and, if these laws are entailed by some theory, then, by virtue of the fact that qualitative confirmation functions satisfy the converse-consequence condition, the experimental evidence also confirms the theory (C&E, p. 412).

We are told that adoption of the converse-consequence condition is a sufficient condition for resolving the problem. It should be noted that Brody's argument presupposes that experimental evidence does not directly confirm theoretical hypotheses. Noting this, Brody concedes that the converse-consequence condition need not be part of the definition of qualitative confirmation, but insists that any adequate theory must satisfy the converse-consequence condition.

> Although it need not be part of the definition of a qualitative confirmation function, it is still a condition of adequacy for qualitative confirmation functions. After all, in those cases where $f_2$ (G,E) = confirms because there exists an H such that G entails H and $f_1$ (H,E) = confirms, we expect it to be the case (for any adequate qualitative confirmation function that allows for the direct confirmation of theoretical hypotheses) that the evidence E directly confirms G. So in either case, we do have, and *must have*, something like the converse-consequence condition (C&E, pp. 413-14, emphasis mine).

This, however, is a restatement of the first argument in more general terms. If my argument is sound, it militates against this argument equally. So, if experimental evidence directly confirms theoretical hypotheses, the converse-consequence condition is unnecessary.

If the confirmation of theoretical statements by experimental evidence is indirect, on the other hand, it is still not clear that the converse-consequence condition is needed in order to make sense out of confirmation, although the case against that view is not decisive. A theoretical hypothesis in conjunction with the appropriate observational generalization does not always imply the experimental evidence. But in order for the converse-consequence condition to be necessary, there must be such an implication. Let us, then, consider only those cases where the theoretical hypothesis and observational generalization imply the experimental results. Is it the case that the evidence confirms the theoretical hypothesis *because* the theoretical hypothesis and observational generalization imply the evidence? Or is the confirmation a function of something else? The converse-consequence condition would have to be invoked only if the confirmation were a function of logical implication. There are other candidates as to why the evidence confirms the theoretical hypothesis. Perhaps the evidence corroborates it because we were able to *predict* the experimental results with the theoretical hypothesis. Again, perhaps that hypothesis is the *best explanation* of why the experimental results obtain, a candidate Brody takes very seriously later, but does not consider at this point (C&E, pp. 423-25). Since those alternatives are not considered at this point, the argument provides no good reason for adopting the converse-consequence condition.

Brody's third and final argument consists of an appeal to our intuitions:

> But there are also extremely powerful intuitive motivations for the converse-consequence condition. After all, when some observational data confirm a law, it is not the case that the evidence exhausts the content of the law. Rather, given the fact that part of what the law says (the part embodied in the evidence) holds, the fact serves to confirm the hypothesis that the rest of what the law says also holds. But if this is so, why shouldn't the data also confirm a more general law (or a theory) (C&E, p. 414)?

My intuitions differ from these. Of course, no observational datum exhausts the content of a law. If that were the case, then the so-called law would be a report of an observation. But even supposing that the law logically implies the sentences describing the observations, it has not been shown that the confirmation of the law by the observations is *a function of* that implication.

If the converse-consequence condition were true, then any evidence for a hypothesis would corroborate any theory of which that hypothesis is a proper subset. But is this an intuitive result of the converse-consequence condition? I do not think so. Suppose that evidence *E* confirms the hypothesis, 'The moon rotates around the earth more or less as in Ptolemy's theory'. I should not infer that *E* also confirms 'Planets rotate about the sun in orbits concentric to the earth' or confirms 'The closer a planet is to the sun, the faster it moves' despite the fact that all three hypotheses are part of the same theory. After all, the first hypothesis refers to the rotation of the moon, whereas the second and third refer to the movement of the *planets*. Again, observations of one planet constitute evidence for the hypothesis, 'The planets move in elliptical orbits'; whereas those same observations do not corroborate the claim, 'The squares of the periods of revolution of any two planets are in the same ratio as the cubes of their mean distances from the sun'. Evidence for the latter requires observation of at least two planets. Here again, however, we have two hypotheses that are part of the same theory. As a rule, there are very good reasons for saying that evidence for a single hypothesis does not confirm an entire theory. Therefore, the aforementioned result of the converse-consequence condition is not at all intuitive.

At the beginning of this paper I noted three claims on behalf of the converse-consequence condition: (i) it cannot simply be dropped; (ii) it can



be dropped only if it is replaced with some condition that often entails the same thing; and (iii) it sheds much light on the process of qualitative confirmation. I think I have shown that the converse-consequence condition does not illuminate qualitative confirmation and that it can be replaced by a non-syntactical condition that does not have the same implications. Given Hempel's and other objections to the converse-consequence condition, I think it ought to be dropped.

This might be too hasty, as Brody eventually defends something he takes to be similar to the converse-consequence condition. Although I have shown that the converse-consequence condition does not illuminate qualitative confirmation, the replacement must be considered in order to assess the other two claims. Earlier, I noted that Brody takes seriously the suggestion that experimental results confirm a hypothesis because the hypothesis is the best explanation of the results, an attitude that is reflected in his proposed replacement for the converse-consequence condition:

If *E* confirms $H_1$, and $H_2$ explains $H_1$, then *E* confirms $H_2$.

Let us call this the "explanation condition." Is the explanation condition similar to the converse-consequencey condition? Does it often entail the same thing as the converse-consequence condition?

It seems to me that the explanation condition is sufficiently *unlike* the converse-consequence condition to justify my earlier assertion that Brody abandons it altogether without recognizing the fact. Brody notes that a hypothesis might entail another without explaining it (C&E, p. 423) and that a hypothesis might explain another without entailing it (C&E, p. 424). If implication is neither a necessary nor a sufficient condition for explanation, then confirmation of a hypothesis by evidence for another is *not* a function of implication if the explanation condition is true. The explanation condition is not syntactical, whereas the converse-consequence condition is. The explanation condition differs markedly from the converse-consequence condition.

Does the explanation condition often entail the same thing as the converse-consequence condition? I suppose the answer is "yes" or "no," depending on how the phrase 'the same thing' is interpreted. Brody does say, "The first thing to note is that if $H_2$ explains $H_1$, it is often the case that it [$H_2$] will also entail $H_1$" (C&E, p. 423). If that is so, then there are *some* cases in which a hypothesis that is confirmed by evidence for another hypothesis entails it. But is that an entailment of the "same thing" as the converse-consequence condition? One difference is that the converse consequence condition, but not the explanation condition, implies that in *every* case that *A* implies *B* and *E* confirms *B*, *E* confirms *A*. Brody says this much. But there is another difference that is only implicit. The converse-consequence condition suggests that *E* confirms *A* *because* *E* confirms *B* and *A* implies *B*, whereas the explanation condition does not. So, our