The Wrong Problem:
Relevance and Irrelevance in Bayesian Confirmation Theory

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Abstract

On various probabilistic accounts of confirmation, including Bayesian confirmation theory, if a piece of evidence confirms a hypothesis, it also (usually) confirms the conjunction of that hypothesis and another, irrelevant hypothesis. Various writers have argued that this is no problem for the Bayesian approach, but they have ignored what I take to be by far the more serious (and more historically important) of the two problems raised by irrelevant conjunctions.

I sketch a framework for solving, in a purely Bayesian way, this more serious problem, and begin to investigate the possibility of a solution.

It turns out, however, that the serious problem is also, in a sense, the wrong problem to solve: it embodies a presupposition that is not true for Bayesian confirmation theory. Once the falsehood of the presupposition is appreciated, the serious problem breaks into two parts, of which only the second is philosophically interesting. This—finally!—philosophically interesting problem appears not, however, to be solvable by purely Bayesian means. A more sophisticated, though not entirely unBayesian, approach to questions of relevance and irrelevance is proposed.

1. Two Problems of Irrelevant Conjunction

1.1 Irrelevant Conjunction

Take a hypothesis h and a piece of evidence e that uncontroversially confirms h; to put it in Bayesian terms, assume that the observation of e would raise the probability of h, or equivalently, that $C(h|e)$ is greater than $C(h)$. Throughout I will assume that this is a sufficient condition for e's confirmation of h.

Consider another hypothesis j that has nothing much to do with h, nor with e. If h is *All ravens are black* and e is the observation of a particular black raven,[1] then j might be, as Glymour suggests, *The provost of Stanford is infallible*. Intuitively, j is irrelevant to h (and also to e). Create the hypothesis that is the conjunction of h and j. On some theories of confirmation, e will confirm the conjunction. Bayesian confirmation theory more or less belongs with these theories, since increasing the probability of a conjunct will increase the probability of the conjunction, provided that neither e or h is negatively relevant to j, a proviso that looks to be true when j is irrelevant in the sense I have described.

In short, if e confirms h, then e will confirm hj, where j is any irrelevant conjunct you like. This raises two problems, one important and the other the subject of the most of the relevant literature. Let me explain.

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1. More exactly, the proposition that such an observation is made.

1.2 Irrelevant Conjunction in History

I begin by rehearsing briefly the role of irrelevant conjunction in the history of confirmation theory. The principal victim of irrelevant conjunction is, of course, hypothetico-deductivism, on which a hypothesis or theory is confirmed by its predictions, where a prediction is understood to be anything entailed by the theory together with some relevant initial conditions.

Hypothetico-deductivism is committed to what Hempel (1945) calls the *converse consequence condition*:

> If evidence e confirms a hypothesis h, then e confirms any hypothesis or theory that entails h,

since by entailing h, this stronger hypothesis also entails (once initial conditions are added) e, and as an entailer of e is, by hypothetico-deductivism, confirmed by e.

Independently of any other views about confirmation, Hempel endorses the *special consequence condition*:

> If evidence e confirms a hypothesis or theory h, then e confirms any hypothesis entailed by h,

a special case of his more general *consequence condition*.

If the special consequence condition is true, as Hempel suggests, then a reductio of hypothetico-deductivism is possible:

1. Take some e and some h such that h entails e and so is confirmed by e.

2. Take an irrelevant hypothesis *j* and conjoin it with *h* to form the "theory" *hj*.

3. By the converse consequence condition, *e* confirms *hj* (since *e* confirms *h* and *hj* entails *h*).

4. By the special consequence condition, *e* confirms *j* (since *e* confirms *hj* and *hj* entails *j*).

But now you have *e* confirming a hypothesis *j* that can be pretty much anything you like. Because a black raven confirms *All ravens are black*, for example, it will also confirm the thesis of the Stanford provost's infallibility.

1.3 Domains of Consequence

Hempel himself used this argument not against hypothetico-deductivism, which he rejected for independent reasons (essentially, the Quine-Duhem problem), but against converse consequence itself: if special consequence is accepted, then converse consequence must be rejected. More neutrally, at least one of converse and special consequence must be rejected.

Twenty-first century confirmation workers are likely to reject both. A committed Bayesian will hold that converse consequence has exceptions and is therefore false, since when *e* confirms *h* but strongly disconfirms *j*, it will in most cases not confirm *hj*. Bayesian counterexamples to special consequence can be constructed in similar ways.[2]

2. For example, when *e* strongly confirms *h* and mildly disconfirms *j*, it will often enough

For all this, the debate over irrelevant conjunction in the Bayesian literature is still, in a certain sense, a debate about the same issue that concerned Hempel. Though neither converse nor special consequence is, on the Bayesian approach to confirmation, exceptionlessly true, both principles are, as it were, locally true: they hold over several broad classes of cases.

Converse consequence is true, as already noted, for most irrelevant conjunctions: when e raises the probability of h, it will raise the probability of hj for an irrelevant j.[3] Special consequence is true for most irrelevant *disjunctions*: when e raises the probability of h, it will raise the probability of $h \vee j$ for some irrelevant j.

Special consequence is also usually true, on the Bayesian and you would hope every other approach to confirmation, when the consequence in question is an instance of the entailing theory, so that for example, evidence that confirms that all ravens are black also raises the probability that the next observed raven is black. It is because special consequence applies in such cases that ampliative inference is even possible; this is why Glymour (1980, 31), for example, and I suspect Hempel, have been inclined to strongly prefer special consequence to converse consequence.

I will talk, then, of the domain over which converse consequence holds and the domain over which special consequence holds, according to some

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confirm hj. Thus, it confirms hj but not a logical consequence of hj, namely, j.

3. The precise scope of this claim depends, of course, on what "irrelevance" amounts to. I will omit this qualification in what follows.

given theory of confirmation. As I have pointed out, according to Bayesian confirmation theory, converse consequence holds over the domain of irrelevant conjunctions, and special consequence holds over the domain of irrelevant disjunctions.

This way of speaking could stand to be made more precise. Rather than formalize the notion of the domain of some consequence principle, which turns out to involve problems the resolution which will not advance the main lines of argument in this paper, let me define what it is for conjunctions and conjuncts to fall within the domain of the consequence principles. First conjunction and converse consequence:

> A conjunction belongs to the domain of converse consequence with respect to a conjunct if confirmation of the conjunct confirms the conjunction.

Note that domain membership is relative to a conjunct; it is also relative, though I do not make the relativity explicit here, to a piece of evidence. The relativization is necessary to capture that fact that in Bayesianism, for example, a conjunct may be irrelevant in the company of one piece of evidence but not another.

Next, conjuncts and special consequence:

> A conjunct belongs to the domain of special consequence with respect to a conjunction if confirmation of the conjunction confirms the conjunct.

Relativization is even more important here. Similar formulations capture what it is for disjuncts and disjunction to fall, respectively, into the domains of converse and special consequence.[4]

Using this somewhat more precise vocabulary, I will again spell out the way in which the irrelevant conjunction problem can arise for a theory of confirmation to which neither converse nor special consequence applies universally. What causes a problem is a certain sort of overlap between the domains of the two consequence principles, namely, a case in which an irrelevant conjunction belongs to the converse consequence domain relative to the relevant conjunct and the irrelevant conjunct belongs to the special consequence domain with respect to the same irrelevant conjunction. The irrelevant conjunct will then, despite its irrelevance, be confirmed.[5]

Wherever there is an overlap of the converse and special consequence domains, confirmation will flow up from an entailee to an entailer, and then down from the entailer to a different entailee.[6] This phenomenon is an em-

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4. A disjunction belongs to the domain of special consequence with respect to a disjunct if confirmation of the disjunct confirms the disjunction. A disjunct belongs to the domain of converse consequence with respect to to a disjunction if confirmation of the disjunction confirms the disjunct.

5. As is sometimes noted, there is a parallel phenomenon when the two domains overlap with respect to an irrelevant disjunction. If an irrelevant disjunction belongs to the special consequence domain with respect to the relevant disjunct, and the irrelevant disjunct belongs to the converse consequence domain with respect to the disjunction, then what confirms the relevant disjunct will also confirm the irrelevant disjunct.

6. In Bayesian confirmation theory, I should note, this notion of confirmation flow is strictly metaphorical: there is no order, temporal or logical, in which different hypotheses

barrassment when the entailer is an irrelevant conjunction, but the same flow pattern is the lifeblood of induction. For example, the observation of one black raven confirms an entailer, the law *All ravens are black*, and so increases my reason to believe a different entailee of the law, that the next raven I observe will be black. The pattern itself cannot be faulted, then; only in certain circumstances is it fatal.

1.4 Bayesianism and Irrelevant Conjunction

What, then, is the problem posed by irrelevant conjunction for Bayesian confirmation theory? Irrelevant conjunctions fall into Bayesianism's converse consequence domain. Confirmational chaos would ensue if Bayesianism's special consequence domain also included irrelevant conjuncts, *any* irrelevant conjuncts. As I have noted, Bayesianism has a rather large special consequence domain. How can we be sure that it is not large enough to embrace a few irrelevant conjunctions? What if, for some hypothesis h, evidence e, and irrelevant proposition j, the evidence e's confirmation of hj "rubs off", as Rosenkrantz (1994) puts it, on j, so that e's raising of hj's probability raises, to some degree, j's probability? Showing that this illicit probabilistic transfer does not happen, that it cannot happen, is the *real* problem of irrelevant conjunction for Bayesian confirmation theory.

But you would not know it from the literature. Most writers are happy

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are confirmed on the observation of a piece of evidence.

to dismiss the problem by noting that the Bayesian domain of special consequence is restricted—that not *every* proposition falls into Bayesianism's special consequence domain.[7] I hope that you can see that this response is in itself quite inadequate.

Perhaps neglect of the real problem of irrelevant conjunction is also explained in part by the perception that, in practice, there are no illicit probabilistic transfers. Though irrelevant conjunctions get confirmed constantly, the irrelevant conjuncts remain untouched. Observation of this pattern in the everyday workings of Bayesianism is reassuring, perhaps good enough for government work, but it is hardly philosophy. We need to be sure that irrelevant conjuncts are *never* confirmed, and to see *why* this is so.

If the real problem of irrelevant conjunction has been ignored, what are all the Bayesians writing about? They worry that simply to have irrelevant conjunctions fall into Bayesianism's converse consequence domain is an embarrassment. In other words, it somehow seems wrong to say that, when e confirms h, it thereby confirms h's conjunction with an irrelevant j (Earman 1992; Rosenkrantz 1994; Fitelson 2002).

Is it so obviously wrong? Hempel seemed to think that converse consequence was plausible enough on its own, until it imploded on contact with special consequence, and he was also happy to endorse equally odd-looking implications of special consequence, for example, the confirmation of irrel-

7. See, for example, Rosenkrantz (1994, 470).

evant disjunctions.

But even if there truly is something that strikes us as peculiar about the confirmation of irrelevant conjunctions, it may be that we, not the converse consequence condition, are out of tune with the confirmational world. I say this because I fully endorse Patrick Maher's argument that, once we appreciate that confirmation in the Bayesian sense is a probabilistic relation, we should accept the confirmation of irrelevant conjunctions with a serene heart. For evidence *e* to confirm *hj* is nothing more than for *e* to raise the probability of *hj*; it is quite normal for evidence that raises the probability of a part to thereby raise the probability of the whole. The problem solved by the Bayesian literature on irrelevant conjunction, then, does not exist (Maher 2004).[8]

I have agreed with what Maher says, but I disagree strongly with what he does not say, that is, with his implication that Bayesianism can put irrelevant conjunctions behind it. The problem of irrelevant conjunction addressed in the Bayesian literature may have been solved, but the real problem of irrelevant conjunction remains.

8. As Maher points out, the "problem" is in any case more ameliorated than solved: the approaches of Earman, Rosenkrantz and Fitelson show that irrelevant conjunctions are confirmed to a lesser degree than the relevant conjunct is confirmed, but still they are confirmed. Rosenkrantz goes the furthest towards a solution, by arguing that in certain cases (though not others) the irrelevant conjunction is barely confirmed at all.

2. Bayesian Solutions to the Real Problem

A Bayesian solution to what I am calling the real problem of irrelevant conjunction must show that irrelevant conjuncts do not fall within Bayesianism's special consequence domain. Such a solution will presumably have two parts: first, a probabilistic definition of what it is for a hypothesis j to be irrelevant relative to a piece of evidence e and another hypothesis h, and second, a demonstration that when e confirms h, and so confirms hj, it nevertheless does not confirm j.

It is easy to see why this might be true: although the probability of hj is increased by the observation of e, so is the probability of $h\neg j$, with the two balancing one another out in just such a way as to ensure no net impact on the probability of j. This is the intuition; what is needed is a plausible definition of irrelevance that can be shown to guarantee such a balancing out. I consider two possible definitions in this section; before I turn to these definitions, however, I want to comment on the uses of the present investigation beyond the problem of irrelevant conjunction.

2.1 Glymour's Relevance Problem

A central problem of confirmation theory, argues Glymour (1980), is the following kind of relevance problem. Kepler's theory of planetary motion has three laws. The first law states that planetary orbits are elliptical, the second that a planet's orbit sweeps out equal areas in equal times, and the third that the orbital periods T and radii r of any two planets are related in this way:

$$\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{T_1}{T_2}\right)^2.$$

Suppose that you have only ever observed the orbit of a single planet. Your orbital observations stand to confirm Kepler's first and second laws, but not the third law. They can confirm the third law only once you have observed the orbit of another planet.

Observations of a single orbit, then, confirm a part of Kepler's theory, and so raise the probability of the whole, without confirming—without raising the probability of—another part of the theory, the third law. In the schema developed above, the third law does not belong to the special consequence domain of the true theory of confirmation, with respect to Kepler's complete theory (and, it should be added, with respect to the evidence, that is, to the observations of a single orbit). This is equivalent to saying, in more familiar language, that the observations do not confirm the third law relative to Kepler's theory.

A theory of confirmation should explain facts such as these. Bayesians in particular, should explain why, although observations of a single planet confirm not only Kepler's first two laws, but in so doing, raise the probability of the complete theory, the probability boost imparted to the theory does not carry over at all to the third law. This is the problem of showing that, while Kepler's complete theory belongs to Bayesianism's converse consequence domain, the third law does not belong to its special consequence domain.

You will see, I hope, that formally at least, Glymour's problem is just the same kind of problem as the irrelevant conjunction problem. It is reasonable to hope, then, that a technique developed to solve the conjunction problem can be applied to the Glymour problem. In particular, perhaps the Bayesian solution to the Glymour problem consists in showing that the third law has a certain kind of irrelevance property relative to the evidence, and demonstrating that this property excludes the third law from the domain of special consequence.

Of course, Kepler's third law is neither irrelevant to the other laws nor to orbital observations in any colloquial sense of *irrelevance*. But once upon a time, I held out hope that the correct technical definition of irrelevance would show the way to solving, within the Bayesian framework, not only the irrelevant conjunction problem, but also the rather more inherently interesting Glymour problem. That would be a pretty trick. I am sorry to report that it is not a trick I will be able to perform in this paper; on the contrary, I hope to persuade you, over the remainder of this section and the beginning of the next, that the entire project is misconceived.

2.2 Strong Irrelevance

In the next two subsections, I consider two possible Bayesian definitions of irrelevance, and learn a lesson from each.

The first definition is taken from Fitelson (2002); I will call it strong irrelevance. A proposition j is irrelevant in Fitelson's sense in the context of evidence e confirming a hypothesis h just in case j is probabilistically independent of h, e, and he.

Fitelson shows that for a strongly irrelevant hypothesis j, the irrelevant conjunction hj is less strongly confirmed by e than is the hypothesis h.[9] This theorem does not on its own address the real problem of irrelevant conjunction. But could another theorem based on the same definition of irrelevance do the trick?

The theorem would show that, if j is strongly irrelevant to h and e, then j is not in the special consequence domain with respect to hj, that is, e does not confirm j.

The theorem is true, and the proof is very easy. Among the properties required for strong irrelevance is j's independence of e. To assume strong irrelevance, then, is to assume explicitly that

$$C(j|e) = C(j)$$

from which it follows immediately that the observation of e has no impact on the probability of j.

Success? Hardly. The desired conclusion turned out to be an explicit part of the initial assumption of strong irrelevance. To assume the strong irrelevance of an irrelevant conjunct, then, you must already know that irrelevant

9. This is shown only for some measures of the degree of confirmation; it does not hold, as Fitelson notes, for the ratio measure.

conjuncts fall outside Bayesianism's special consequence domain. There is no insight to be found here as to why special consequence does not apply to irrelevant conjunctions, nor as to what underlies judgments of Glymourian irrelevance.

2.3 Weaker Irrelevance

Hawthorne and Fitelson (2004) suggest a weaker notion of irrelevance that I will call weak irrelevance (noting that there are many other kinds of irrelevance that are similarly "weak"). A proposition j is weakly irrelevant in the context of evidence e confirming a hypothesis h just in case e is independent of j given h, that is, just in case

$$C(e|hj) = C(e|h).$$

You will see that weak irrelevance is implied by strong irrelevance, but not vice-versa.

Hawthorne and Fitelson claim that weak irrelevance captures the following intuitive irrelevance relation: j says nothing more about e than h already says (in the context of the background knowledge). If Hawthorne and Fitelson are correct, then their variety of irrelevance looks very promising as a foundation for solving the Glymour problem, since plausibly, the failure of the observation of a single orbit to confirm Kepler's third law is closely related to the fact that adding the third law to the first two makes no additional predictions about a single orbit. In other words, everything that

Kepler's laws have to say about a single orbit in isolation, is said by the first and second laws.

There are two questions, then, that I would like to ask about weak irrelevance: First, does weak irrelevance succeed in capturing the intuitive notion of relevance as claimed? Second, is the weak irrelevance of a hypothesis j relative to h and e sufficient for that hypothesis not to be confirmed by e, even if the conjunction hj is confirmed?

The answer to both questions is no, as a consequence of the following fact: Weak irrelevance can hold even if $C(e|j)$ is greater than $C(e)$, provided that there is an "interaction effect" between h and j that exerts a negative probabilistic pressure on e exactly balancing the positive probabilistic pressure on e due to j.

Since, whenever $C(e|j)$ is greater than $C(e)$ the evidence e will confirm j, weakly irrelevant conjuncts can be confirmed. Thus the weak irrelevance of a conjunct does not exclude it from Bayesianism's domain of special consequence.

Further, in the scenario just described, j has quite a lot to say, some positive, some (in the context of h) negative, about e, but the effects of the positive and negative cancel out exactly. Thus the weak irrelevance of j relative to h and e fails to capture just those cases in which j has nothing to say about e beyond what is said by h.

Can the definition of weak irrelevance be amended to solve these shortcomings? Conditions must, after all, be quite contrived for j's positive and negative impacts on the probability of e to cancel out exactly. Perhaps something can be added to rule out this contrived state of affairs? Or perhaps a different probabilistic definition of irrelevance will give you everything you want?[10]

I think not. The problem is not with weak irrelevance in particular, but with probabilistic definitions of irrelevance in general. Such definitions take the form of one or more probabilistic independence claims. There are always two ways that such claims can be satisfied. First, the independent propositions can, in the intuitive sense, genuinely have nothing to do with one another. But second, they may have quite a lot to do with one another, both positively and negatively, but the impacts may cancel out.

It is because of this second kind of situation that a probabilistic definition of irrelevance will never capture one of our intuitive notions of relevance, and also, that a probabilistic definition of relevance will never imply the independence of two propositions unless the fact of their independence is itself a part of the definition.

If I am correct, then the problem of irrelevant conjunction cannot be solved by purely Bayesian means—I mean by way of a probabilistic definition of irrelevance—twice over. First, the definition will never capture a sense of irrelevance that we antecedently care about. Second, a definition

10. One possibility: hj is an irrelevant conjunction just in case j and h are independent. Although e is not mentioned explicitly, the definition bears on anything that might impact the probabilities of both j and h.

strong enough imply that irrelevant conjuncts are not confirmed will have to be so strong as to trivialize the result.[11]

Bayesians cannot solve the real irrelevant conjunction problem—a disaster? Not at all, I will argue in the next section. Like its sibling, it is a problem that ought not to be solved.

3. The Wrong Problem Again

3.1 Irrelevant Conjuncts Are Often Confirmed

Revisit an example from section 1.1: a black raven confirms *All ravens are black*, and so confirms, on the Bayesian approach, the conjunction of the ravens hypothesis and the thesis that the provost of Stanford is infallible. It ought not, however, to confirm the infallibility of the Stanford provost. In other words, special consequence ought not to apply to the provost thesis relative to its conjunction with the ravens thesis.

True? Not necessarily. Suppose that the Stanford provost is known to have declared, *ex cathedra*, that all ravens are black. Then a black raven will, after all, go some way towards confirming the provost's infallibility. (If you doubt this, consider the impact on the infallibility hypothesis if the provost had declared that no ravens are black.) That this is so is not due to any inherent property of the three propositions in question: the ravens thesis, the

11. I mean that the proof that the irrelevant conjunct will not be confirmed will be uninteresting.

infallibility thesis, or the observation report of a black raven. It is due rather to the background, the fact that the provost happens to have made a statement that is connected to (in this case, identical to) the ravens thesis. All Bayesians acknowledge that the background has this role to play in determining probabilistic relevance, but they have not thought hard enough, or so I will argue, about the consequences for the problem of irrelevant conjunction.

The provost example may strike you as rather contrived. Take another example, drawn from Fitelson (2002): an observation of a comet, let's say, confirms Newton's gravitational force law, and so confirms the conjunction of Newton's law with Coulomb's electrostatic force law, but ought not in so doing to confirm Coulomb's law itself.

Plausible though it sounds, this is not in general true. The observation of the comet confirms the gravitational law because the movements of the comet are those predicted by the law on the assumption that no other forces are acting on the comet, or at least, that such forces are negligible. This no-force auxiliary hypothesis is confirmed along with the gravitational law by the observation of the comet's orbit (Strevens 2001).

The no-force hypothesis is itself a prediction of the sum total of all the known force laws, together with the thesis that the known force laws are the only force laws. When the no-force hypothesis is confirmed, our confidence in all the force laws should increase, including our confidence in Coulomb's law.[12] Thus the observation of the comet does, after all, confirm the supposedly irrelevant conjunct Coulomb's law.[13] This is not a contrived example; this is the scientific condition.

3.2 *Morals of the Story*

What can be learned from this? At the very least, the following two lessons.

First, the intuitive sense of *irrelevance* at play in the problem of irrelevant conjunction does not guarantee exclusion from Bayesianism's special consequence domain; in fact, it does not even come close to doing so. This is also true, I suggest, of the kind of irrelevance, whether the same or different, that figures in the Glymourian relevance problem. Thus, the fundamental presupposition on which the real problem of irrelevant conjunction rests—that irrelevant conjuncts are not, and should not be, confirmed—is false.

Second, there are, after all, no interesting, systematic facts about the scope of Bayesianism's special consequence domain (nor its converse consequence domain). Membership of the domain depends too much, in a piecemeal way, on the background.

From these lessons, it follows, I suggest, that what I have called the real problem of irrelevant conjunctions is also a wrong problem: there is simply

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12. This is a legitimate form of special consequence.

13. The degree of confirmation is of course tiny, but that is because Coulomb's law is already so well confirmed, not because of the indirect path by which the comet is relevant to the law. Even a direct test of Coulomb's law will, today, confirm it only to a vanishingly small degree.

no point in trying to show that irrelevant conjuncts, in any natural sense of *irrelevant*, do not fall into the special consequence domain.

The "real" problem turns out to consist of two separate pieces:

1. The problem of determining what kinds of probabilistic conditions are sufficient for exclusion from Bayesianism's special consequence domain.

2. The problem of how to characterize the intuitive sense or senses of *relevance* that appear in the irrelevant conjunction and Glymour problems.

As to the solutions of these problems, I make two claims.

First, with respect to problem (1), there is no non-trivial probabilistic necessary or sufficient condition for exclusion from the special consequence domain. Second, with respect to problem (2), a characterization of relevance in a confirmationally interesting sense will have to go beyond the probabilistic relations between propositions, to other kinds of structural relations. I discuss these in turn.

3.3 No Formal Theory of Special Consequence

There will turn out to be no mathematically interesting probabilistic necessary or sufficient condition for exclusion from the special consequence domain. In those perhaps very few cases where exclusion occurs, the most that can be said will be: things worked out so that the relevant conjunct j was independent of the evidence e, and thus was not confirmed by e.

One reason for advancing this claim was given in section 2.3: any non-trivial probabilistic definition of relevance can be satisfied in two ways, one of which makes room for the positive relevance of the evidence to the irrelevant conjunct.

I have another reason as well. As the discussion in of the provost's infallibility and Coulomb's law from the last section shows, whether or not a conjunct is confirmed when its partner in conjunction is confirmed depends potentially on all the other propositions. As long as there is some proposition k in the background that has something to do with both conjuncts—such as the provost's claim that all ravens are black, or the no-force thesis—there is the quite likely prospect that the confirmation of one will impact to some degree the probability of the other. To rule out the existence of such connections, you would have to know something about the probabilistic relevance relations between everything and everything else. But if you know all of this, then you already know enough to see whether the evidence will confirm the putatively irrelevant conjunct. There is no interesting local fact about probabilistic relevance that you can leverage, then, to gain knowledge about the confirmation or otherwise of an irrelevant conjunct. In effect, every inductive relation there is must be known in advance to make these judgments. Thus no technical definition of relevance will be at all useful to us in ruling out the possibility of the confirmation of any class of conjuncts; there is, as I say, no way to characterize probabilistically the unconfirmed conjuncts except through the very fact of their unconfirmedness.

3.4 No Probabilistic Definition of Relevance

A characterization of relevance in a confirmationally interesting sense will have to go beyond the probabilistic relations between propositions, to other kinds of structural relations. These structural relations will have (defeasible) probabilistic consequences, but they will not themselves be probabilistic.

For example, a solution to the Glymour problem will show that Kepler's first two laws have, in virtue of their content, a certain non-probabilistic relation to the observations of the orbit of a single planet that the third law lacks. It will be shown further that the existence of these relations tends to affect (or ought to affect) the likelihoods so that the observations of a single planet confirm the first and second laws but not the third. In other words, the solution will display certain kinds of structural relations between hypotheses that channel confirmation. The Bayesian probabilities will follow these channels, when the background is right, but the resulting probabilistic relations ought to be considered symptoms rather than causes.[14]

There are two reasons to accept this claim. First is the argument from the discussion of weak irrelevance, that any probabilistic definition intended to capture an intuitive, confirmationally interesting relevance claim can be

14. For an example of this kind of program applied to the Quine-Duhem problem see Strevens (2001).

satisfied in two ways, either due to the intuitive irrelevance relation holding true, or due to the balancing out of various effects arising from the violation of the same irrelevance relation. It follows that confirmationally interesting irrelevance is not necessary for probabilistic irrelevance.

Second, as the discussion of the Stanford provost and Coulomb's law above shows, theses that are irrelevant to one another in the confirmationally interesting sense or senses can be relevant in the probabilistic sense, so that the confirmation of one thesis can impact the probability of another, intuitively irrelevant thesis. In short, confirmationally interesting irrelevance is not sufficient for probabilistic irrelevance.

Are probabilistic relevance and irrelevance relations ever interesting? If so, only because they reflect and quantify, however imperfectly, underlying non-probabilistic relevance relations. Probability is a part of the story of confirmation, but it is not the whole story or even the most fundamental part of the story. Confirmation theory needs Bayesianism, or something like it, but Bayesianism needs confirmation theory more.

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