Prescience and Statistical Laws[1]

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In the course of arguing that God's knowledge of future events is inconsistent with their contingency, Jonathan Edwards writes as follows.

> There must be a certainty in things themselves, before they are certainly known, or (which is the same thing) known to be certain. For certainty of knowledge is nothing else but knowing or discerning the certainty there is in the things themselves which are known.[2]

The intuitions Edwards expresses so clearly here seem to have impressive heft, and I believe them to be a source of confusion for contemporary philosophers, who, unlike Edwards, find themselves having to live with statistical laws. I am going to do my best to sweep away this confusion.

What is Edwards claiming in the above passage? From things he says elsewhere, it is clear that 'certain' is being used in a sense that encompasses all things past, and all things linked to these by necessary causal connections. This can be regarded as a sort of necessity. In a way, then, what Edwards says is trivial: $L\phi$ will follow from $LK\phi$ by distribution of L over $L[K\phi \rightarrow \phi]$, which seems to be a logical truth.

To complete a proof that whatever is known must be certain, then, we need a principle to the effect that all knowledge must be certain knowledge. In the passage in question, Edwards is referring to God's knowledge, and this principle would be justified by theological considerations. Here, however, I want to consider this principle as it applies to knowledge in general, including human knowledge.

This brings us to the following scheme.

(1) $K\phi \equiv \mathrm{LK}\phi$

Here K is a sentential "it is known" (or "it is known by x") operator. L is the "settledness" operator; I'm supposing that time may branch towards the future, and $L\phi$ is true at a

[1] History of this document:

> This document was prepared as a dittograph and privately circulated in 1980. It was converted to LaTeX in 1988, but not circulated at this time. Some minor corrections were added in 2016. The original version has a footnote saying "Hasty and very rough first draft." That remains true. There are some handwritten additions and clarifications that are not included in this version.

[2] *Freedom of the will,* Part III, Section 13.

moment iff ϕ is true at that moment with respect to all scenarios through that moment (paths to the future through that moment). Thus, (1) says that you know something only if your knowledge cannot be overturned by any subsequent course of events.

This has a certain insidious plausibility. Nevertheless, (1) represents a false principle. To illustrate this, I will contrast two cases. What they have in common is that I play a squash match with an opponent and win; and before the match I tell you, quite sincerely, that I will win. In the first case, although I feel I will win, we are evenly matched, we played quite recently and I lost, and there is nothing special to distinguish this occasion from the previous one. (In fact, the last time I felt I'd win.) In the second case I am playing a weaker player whom I have played several times. On both occasions when we played before, I won without too much trouble, and this time I win in much the same way. (Occasionally though, I do have a bad day and have lost to weaker players.)

In the second case, I knew I would win, though in the first I didn't. Without getting tangled in a general statement of the matter we can say what the difference is. In the second case I could give a good account of why I *would* win, and as it turns out this remains good as an account of why I *did* win. In the first case I have no such account.

Nevertheless, it wasn't impossible for me to lose that match against the weaker opponent. Anyone can win a point by flailing out and hitting an unreturnable shot. Win enough points and you win the game, win enough games and you win the match.

So when I said I would win there was a scenario on which I lose. It is possible, even if it is very unlikely. Follow this scenario, and we have a course of events on which it is *false* that I knew I would win. So before the game it is certainly not settled that I know I will win. But relative to the way things actually turned out—on the scenario in which I win—it is true that I know I will win. Thus, an instance of (1) is false: its left side is true and its right side false.

I can sum the point up by saying that knowledge claims can be risky, just as simple claims about the future can be risky. When I say I will win, is what I say true? It depends on the future. When I say I know I will win, is what I say true? It's much the same.

There are those who will say that knowledge *is* certain knowledge. If there is a future course of events undercutting a claim to know, the claim is false. This is like saying that beauty is perfect beauty, so that the tiniest wart must defeat a pig's claim to beauty.[3]

I think this clears up one problem people have about statistical laws. If a law is a general principle (preferably quantitative) that gives us knowledge about the future, how can statistical laws be laws? The claims to know that they furnish are risky, so this is not real knowledge. Reality here has been conflated with certainty; knowledge is no less real for being uncertain.

Another problem remains, having to do with laws and conditionals. It is Statistical Law that the half life of radium is 1600 years.[4] We observe a 2 gram sample of radium and notice

[3]For a discussion of the general point, see what David Lewis has to say about flatness in "Scorekeeping in a language game." *Journal of Philosophical Logic 8* (1979), pp. 351-354. I am brief here because Lewis' treatment is thorough and convincing.

[4]If this is wrong blame Bas van Fraassen, don't blame me.

that 1 gram remains after 1600 years. Does the law tell us that if a certain atom in the original sample—call it Charlie—hadn't decayed, some other atom would have? I think not. If Charlie hadn't decayed this wouldn't affect the result in any measurable way. But what if we throw in some of Charlie's friends? Suppose that Dennis is a set of atoms that did decay, containing enough to weigh one picogram. If the atoms in Dennis hadn't decayed, would some other set, containing roughly the same number of atoms, have suicided?

The answer to this is a flat "No:" (2) is simply false.

(2) If the atoms in Dennis hadn't decayed, some atoms that did not in fact decay would have decayed.

This principle is false because of general considerations linking causal independence to the truth conditions of tensed conditionals.[5] These same considerations make it true (and in fact, settled) that if a certain nickel is going to come up heads, then it will still come up heads even if a quarter were to come up tails instead of heads, where it is assumed that the two tosses are independent.

I may not understand causality very well, but in our paper on conditionals and tense, Anil Gupta and I propose a way of representing *causal independence* and of relating this to conditionals in a way that seems to give the correct truth conditions. The crucial point as regards the matter at hand is that the representation of causal independence is modal. It involves—not quite a set of possible worlds—but a set of functions telling us what course of events would have come about at any moment. The effect of causal independence on conditionals is that the truth of certain suppositions carries over into their consequents. And in particular, on the remaining atoms. What the others *would have done* is just what they in fact *did do.*

The temptation to say that (2) is true may be related to the undoubted fact that the corresponding conditional probability is very high indeed. And if people like Adams and Gibbard are right this also means that the assertability of the indicative conditional is very high indeed.[6] (And no doubt they are right, as far as assertability is concerned.)

In the distant past it might have been possible to confuse conditional probabilities and probabilities of conditionals, but in the enlightened present this distinction is about as well grounded and inevitable as a distinction can be, and it should be no surprise to say that although (2) is false—and false because of general principles having to do with causal independence—the conditional probability is virtually 1, and this is so in virtue of a statistical law.

Insofar as a law assigns probability 0 to certain states of affairs, it will affect the truth

[5] Here I am relying heavily on the theory presented in R. Thomason and Anil Gupta, "A theory of conditionals in the context of branching time," *Philosophical Review 89* (1980), pp. 63-90. In particular, see the discussion of causal independence on pp. 82-88.

[6] See, for instance, D. lewis, "Probabilities of conditionals and conditional probabilities," *Philosophical Review 85* (1976), pp. 297-315. Also see A. Gibbard and W. harper, "Counterfactuals and Two Kinds of Expected Utility", in Hooker, Leach, and McClennen (eds.), *Foundations and Applications of Decision Theory, Volume I*, Dordrecht, 1978.

of conditionals about the future.[7] This is common to both statistical and causal laws. But insofar as it is statistical, a law will be insulated from criteria of what *would* happen. For one thing, statistical laws tell us only what is *likely* to happen—rather than excluding certain scenarios they tell us that these possibilities are not to be expected.[8]

But the penny tossing experiments disclose a deeper difference between statistical and causal claims. Two processes that do not differ at all statistically are quite different from a causal point of view, and this difference reveals itself in the truth value of nested subjunctive conditionals. I have argued that if conditions are favorable they yield knowledge, and we certainly can ask for no better guide to life. They are laws. But our reasoning about the future and unrealized possibilities is complex, and not every law has a hand in determining what would have been.

[7]See the Gupta-Thomason paper, pp. 68-71

[8]I hope no one makes the mistake of thinking that the law of radium's half life *rules out* all scenarios in which exactly half of the world's radium atoms do not decay every 1600 years. In this respect, the law is just like the one that says 50 out of 100 tosses of a fair coin will come up heads. This doesn't rule out any outcome, including the one in which every too comes up heads. It does give us a statistical distribution in which the outcome on which half the tosses are heads is likeliest.