SEEING INFERENCES THROUGH A METAPHYSICAL LENS

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In some textbooks, deduction is presented as a limit case of induction where the conclusion is *certain* rather than probable given the premises. In this view, deduction is described through an epistemic lens where inference is described in terms of degrees of belief and evidential support. But the term "certain" can be interpreted in two ways in this context:

(1) In an evidentiary sense, synonymous with certainty;

(2) In a metaphysical sense, meaning "must be true."

In the epistemic reading offered by (1), deductive inferences are simply epistemic acts that judge the conclusion based on the strength of the evidence alone. If the available evidence guarantees the truth of the conclusion, it's deductive. There are a couple of issues associated with this epistemic view. If we adopt this interpretation, any inference where the conclusion is uncertain yet necessitated by the premises would be deemed inductive. Conversely, any inference that lacks truth preservation yet has a certain conclusion would be deemed deductive. I'm not sure anyone would be willing to pay such a heavy price for the epistemic reading[1].

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1 The view that some inferences are genuinely inductive can be named inductivism, and the notion that all inferences are deductive, deductivism. There is something to be said about the metaphysical assumptions of inductivists. The notion that some inductive inferences are inherently probabilistic and irreducible to deductive standards is motivated by the acceptance of modal indeterminism. But modal indeterminism without the acceptance of possibilism is not enough to justify inductivism because in this scenario any inference will collapse to a material implication. This occurs because if possibilism is false, then everything there is, is actual; then all we can say about an inference is whether or not there is a combination with true premises and a false conclusion. This would be true even if some phenomena are random since this would be the only world where these chancy events take place. So it is possibilism, and not indeterminism, that is carrying the epistemic burden for inductivism, and possibilism requires a defense of possibilia. To be fair, it seems that any deductivist would be inclined to accept possibilism, so the debate about the underlying metaphysical assumptions would revolve around the acceptance of indeterminism. Most people would be prone to accept inductivism as a formality, almost as a corollary that follows from the indeterminism of quantum mechanics. But knowing if indeterminism is indeed the only available theoretical framework for quantum mechanics is a philosophical notion that is open to debate.

Now, this framing of the inductivists' assumptions puts deductivists in a difficult spot. If inductivism requires indeterminism, should we infer that deductivism presupposes determinism? If we accept determinism, what follows is actualism because if every event is predetermined by antecedent events and conditions together with natural laws, the

The epistemic reading also pushes deduction into a caricature of infallibility while being prone to soritical problems of its own making. Suppose an event has a 99% chance, which means a belief about its occurrence has a high probability of 0.9. An inference with a conclusion whose probability is 0.9 should be considered inductive because it's not completely certain. However, from a pragmatic perspective, any conclusion with a probability of 0.9 is nearly deductive, to the point where it's practically impossible to differentiate it from a genuine deductive conclusion. This epistemic detail is too small to be detected with "the naked eye," so to speak. The only reason a nearly deductive conclusion is not considered deductive is that there is still a 0.1 probability of it being false. This means that a conclusion would have to be absolutely certain in order to be deductive. But this implies that a reasoner would have to see herself as infallible when making a deduction, which is a caricature.

To avoid turning deductions into caricatures, we can lower the probability threshold for deductive inferences. Let's suppose that a conclusion with a probability of 0.9 can be considered deductive. The question that can now be asked is this: why not choose a probability of 0.8 or even 0.7 as a demarcation point? The problem is that any answer would seem equally arbitrary. Suppose I infer that a belief has a probability of 0.7 because of the available evidence. If new findings increased my confidence in this belief even more could my inductive conclusion suddenly shift into a deductive one? This generates a soritical problem: if an increment of 0.1 is insufficient to make a conclusion deductive, then additional increments will also be insufficient to make it deductive. The consequence is that a deductive conclusion with a probability of 1 would remain inductive, thus

actual world is the only world that exists. Any counterfactual scenario that had the same initial conditions and laws of nature would be identical to the current world. So the deductivist will have to abandon possibilism, and with it, the very notion that in a deduction the conclusion is necessitated by the premises in a modal range. Every inference becomes a material implication, which is the weakest form of deduction.

Let's consider one of the paradigmatic cases of indeterministic phenomena: radioactive decay. The decay of individual atoms is believed to be inherently random, but inferences are made on large samples of atoms that ensure reliable predictions about decay behavior. So the inference is almost certain, nearing 99%, even if the content of the conclusion is uncertain. Suppose such inference is such that it's not the case that the premise is true and the conclusion is false 99% of the time. Each chance represents an epistemic possible world. In a way, this inference is truth-preserving in 99 out of 100 epistemic possible worlds, which means that the conclusion is necessitated-ish by the premises in a specific range. This strategy suggests that deductivism is compatible with indeterminism.

contradicting the earlier assumption that deductive conclusions are certain. This leaves us with option (2).

The alternative presented by (2) introduces a metaphysical view where the conclusion is certain given the premises, in the sense that it must be true given the premises. In other words, the conclusion is necessitated by the premises across all possible worlds, or, to put in other words, there are no possible worlds where the premises are true and the conclusion is false. Now, notice that (1) and (2) are independent. (1) doesn't imply (2) because epistemic judgments have no bearing on metaphysical issues, whereas (2) doesn't imply (1) since logical consequence may not be a luminous event. One might object that once logical consequence is identified the conclusion must be certain in hindsight. But every successful conclusion is trivially certain in hindsight, including inductive ones.

Regarding deductive inferences, it's also important to observe that they have no distinctive propositional form because the supposed paradigmatic examples of deductions, such as *modus ponens* or hypothetical syllogism, are not inferential forms but coherence requirements for inferences[2]. The actual inferential forms in such requirements are the conditionals that are

2 This implies that any inference must be deductive in order to be coherent. One immediate objection is that these are coherence requirements for the type of inference used in these examples, namely, material implication. Since material implication can be considered a formal implication restricted to one world, the argument begs the question against the critics. One reply is that if these examples were not coherence requirements for inferences, the following claim would be coherent:

(3) It's not the case that the premise is true and the conclusion is false, but the conclusion may still be false when the premise is true.

But (3) is incoherent. The critic might object that she subscribes to the following claim:

(3*) It's unlikely that the premise is true and the conclusion is false, but the conclusion may still be false when the premise is true.

But since (3*) is perfectly consistent, there is no incoherence in her objection. However, (3*) is a cop-out since it's motivated by a different claim, namely:

(4) The truthmaker of the premise is what makes the conclusion true, but the conclusion may still be false when the premise is true.

And this is obviously problematic. The point is that (3*) seems plausible because it depends on an epistemic reading of inferences that still leaves basic metaphysical commitments out of the equation. There is only a caveat in the formulation of (4). It's arguable that in most inductions, it's the conclusion that is responsible for the truth of the premise, and not the other way around. When I conclude that every metal will expand when heated because this behavior was observed on a piece of copper, it's the natural law of the conclusion that is instantiated by the premise. So we can have a different formulation:

misinterpreted as premises. Thus, the only thing we can safely say about deductive inferences is that they are such that the conclusion is necessitated by the premises. This freedom from logical form is important because it enables us to apply a modal necessity framework to all forms of inference. For instance, a generalization in mathematics, which is traditionally considered an inductive inference, is actually deductive because the conclusion is necessitated by the premises.

The underlying modal necessity framework of (2) invites a reinterpretation of inferences as truth preservation within a modal range, instead of degrees of confidence and evidential support. The mention of modal range is important because the essence of deduction is that in an inference the conclusion is necessitated by the premises within a specific modal range, not necessarily across all metaphysically possible worlds. There is a case to be made for deductions with varying modal ranges where inferences take place along a modal spectrum of necessity. For instance, it's perfectly

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(5) The truthmaker of the conclusion is what makes the premise true, but the conclusion may still be false when the premise is true.

The incoherence of (5) is even more glaring. If we consider a simple prevision, both the premise and the conclusion will be made true by the same truthmaker, for example, "since this piece of metal expanded when heated, the next piece of metal will expand in the same conditions." So we have something along the lines of:

(6) Both the premise and the conclusion are made true by the same truthmakers, but the conclusion may still be false when the premise is true.

Again, this seems nonsensical. Perhaps the inductivist can claim something as follows:

(7) The truthmaker of the premise makes the conclusion true most of the time, and the premise can be true and the conclusion false.

This is consistent, but then she would have to add the following clause that justifies her inference:

(8) The truthmaker of the premise makes the conclusion true most of the time; if the premise is true, the conclusion is true this time, yet the premise can be true and the conclusion false.

And once again, we have an incoherent statement. The challenge faced by any inductivist is to provide a metaphysical interpretation of induction that is not incoherent. This occurs because there is a difference between inductive inferences as such (generalization and prevision) and indeterministic standards that describe when an inductive inference can be accepted (when the conclusion is likely given the premises). Indeterministic standards are completely silent about the truth values of both the premises and the conclusion, and agnostic about whether the reasoner assumes the truth of the conclusion at all. What happens is that an actual inference requires a commitment to the truth value of the conclusion, but a mere probabilistic assessment only describes the probability of the conclusion based on the available evidence. It's not enough to assert that the conclusion is highly likely given the premises. In order to make an inference, the reasoner has to claim that the conclusion is true given the premises, which means that a commitment to the truth value of the conclusion in the actual world must be made, otherwise nothing is inferred. In other words, inductivism doesn't describe the inferential act that is supposed to express, because it simply reinstates modal indeterminism in a less sophisticated fashion. Paradoxically, indeterminism it's an ontological thesis that only has epistemic assessments to offer. This explains why inductive inferences can be reinterpreted as deductions without inconsistency. Deductivism fills the metaphysical vacuum left by inductivism. After all is said and done, and the commitments to the truth values of premises and conclusion are made, the only available framework to interpret the inference is deductivist.

reasonable to say that a deduction may have a conclusion necessitated by the premises only within the actual world, giving it a narrower modal range than a deduction in which the conclusion is necessitated by the premises across all nomically possible worlds, and so on. There are different levels of necessity for conclusions, different degrees of logical consequence, and a gradation of deductive inferences that is measured by different modal scopes[3].

The most important inductive inferences involve nomic necessities, but knowing how deeply the conclusion is necessitated by the premises depends on whether nomic and metaphysical necessities align. If they are co-extensive, the premises of inferences that rely on natural laws will necessitate the conclusion *tout court*, requiring a substantial group of inductive inferences to be reclassified as full-blown deductions. If they are not co-extensive, they can be divided into two groups: those where the conclusion is necessitated by the premises in all nomic possible worlds, and those where the conclusion is necessitated by the premises only relative to one or more specific nomic possible worlds.

There is also something to be said about cases of inductive inferences that are about matters of probability distribution as such. For instance, I may infer that a tails event has a 50 percent chance of occurring given a coin toss. It's arguable that this conclusion is necessitated by the premise in all epistemic possible worlds since probability calculus is an epistemic necessity. The modalities are as varied as the patterns involved in each inference.

The modal framework perspective provides a unified understanding of inferences necessitated by the premises within specific modal ranges. By analyzing inferences according to their respective modal scopes we provide a view that is more comprehensive and flexible than an epistemic view of inferences.

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3 This is motivated by the following observation: material implication has the same properties of formal implication (deduction), but is restricted to one world. It follows that there are different degrees of implication across a modal range. They all share the same properties, but differ in scope. For a detailed defense of this thesis see my "The Inextricable Link Between Conditionals and Logical Consequence".