MITx Philosophy Award Essay
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Probability: Localism and Primitivism

Part I

One puzzle discussed in week six concerns providing a satisfactory account of objective probability. Professor Rayo's view is localism, summarized as follows:

(1) Objective probability is determined by the objective-subjective connection. That is, objective probabilities are simply the subjective probabilities—or credences—of perfectly rational subjects with complete information about the past.
(2) Subjective probabilities are often not well-defined; there is rarely a coherent way of setting initial credences because the Principle of Indifference may imply that there are multiple valid probabilities for a single event.[1] And acquisition of further information cannot solve the problem, because indeterminate credences updated by conditionalization remain indeterminate.
(3) Therefore, the fidelity of objective probabilities is contextual: they are well-defined just when a perfectly rational subject can create unambiguous initial credences through application of the Principle of Indifference.

One reason to avoid localism is its implication that objective probabilities are often not well-defined. This is undesirable as we would prefer our talk of objective probability to be precise and useful, rather than riddled with indeterminacy. And secondly, localism tethers objective probability to the rational subject—a powerful notion, to be sure—but an unintuitive one, given that we tend to think of objective probability as something "out there" in reality.[2] If any other account of objective probability is viable, then, we should likely prefer to endorse it

[1] The Principle of Indifference mandates that distinct propositions delineating the outcome of an event are to be weighted equally if no available evidence is such as to favor any one of them.

[2] Ideally, it would turn out that the credences of a perfectly rational and informed subject are just coextensive with the objective probabilities, and thus conceptually distinct. This would preserve our *prima facie* sense that there is an *ontological* dimension to probability—that is, a meaningful way in which the world has probabilistic features, *in addition to* requiring a certain set of rational credences. Of course, finding a coherent account of just what "probabilistic features" are is crucial, and will be the central issue of Part II.

over localism. We will try to find such an account in Part II. However, before we attempt our own positive account of objective probability, it is worth trying to critique localism directly.

To reiterate, the most severe drawback of localism is that the incoherence of the Principle of Indifference often makes it impossible to have well-defined objective probabilities. Yet it is hard to argue against the reasoning that buttresses the dreadful conclusion. A radical (and likely incorrect) approach is required. Let's call it the epistemicist revision of localism. The Epistemicist tries to accommodate the rationalist premise that a perfectly rational subject with complete information must always have well-defined credences. Yet the epistemicist also holds that the localist is incorrect in believing that problematic instances of the Principle of Indifference mean that one's credences are not well defined. Instead, the epistemicist thinks that instances where the Principle of Indifference cannot be applied coherently grant no sorts of credences at all. For example, in our cube factory case, the epistemicist holds that no initial credences may be rationally generated just from the information given.[3] As our perfectly rational subject accumulates information, however, she will be able to have well-defined beliefs because of deferring her initial credences until she can properly apply the Principle of Indifference (so as to make her credences well-defined) or gain knowledge some other way.

One objection might be given here: there is no justification for stipulating that the Principle of Indifference sometimes creates no beliefs and other times creates beliefs completely unproblematically. It seems we need a rigorous way of distinguishing problematic and unproblematic cases where the Principle of Indifference is applied. And we need the distinction to properly explain why we are justified in assigning no belief to the bad applications of the

[3] Yet there is still a fact of the matter about what the rational subject ought to believe, namely, nothing.

Principle of Indifference. The best I can do is to speculate that the crucial difference between good and bad use of the Principle of Indifference depends on whether the set of available propositions to distribute one's credences among contain appeals to incommensurable categories (like length and volume, in the cube factory example). Perhaps this explains why the bad cases of the Principle of Indifference can be accepted to contribute nothing to one's credences, because dividing credences between propositions with incommensurable content might just not satisfy the standards of rationality.

Part II

It is worth beginning this section with a summary of what our positive account of objective probability will be, before dealing with the problems it faces.[4] My view is a kind of primitivism. Objective probability is just a property of how matter behaves, rendered to us (at least according to our current understanding) through the mathematics of quantum mechanics.[5] Importantly, this account of objective probability is contingent and ontological. Either it turns out that our best scientific theories vindicate the metaphysical implications of quantum mechanics, or they do not. And if there are in fact irreducible stochastic dynamics, then it is impossible to make statements about, say, the decay rate of carbon-15, without a probabilistic calculus of some sort. If it is instead the case that the behavior of matter is ultimately deterministic, then talk of objective probability will be unnecessary.

[4] The first three paragraphs of Part II use the vocabulary and background information from Maudlin (2011). However, they draw different conclusions with mostly different arguments.

[5] We may state the property of behaving probabilistically simply as behaving in such a way that two identical initial states do not necessitate two identical future states.

It may be objected that probability must still feature prominently in science in a fully deterministic world. Take, for example, the task of specifying the *frequency* that an unweighted die rolls a 6. But frequencies are just useful generalizations. They do not describe the physical dynamics that govern the individual die rolls, and thus could be omitted from the conversation completely, in principle.[6] Perhaps a frequency is best thought of as a version of probability that is pragmatic rather than objective, but in any case, the point stands: frequencies may be a convenient way of generalizing across multiple similar events, but they supply no direct information about the behavior of deterministic systems.

It's also worth noting that this argument applies to the probabilistic properties of statistical mechanics. We assume that the physical dynamics that govern, say, the energy levels of particles given by the Boltzmann distribution, do so deterministically. Any individual particle thus slots into its place in the distribution according to strict deterministic laws, thus, statistical mechanics does not require probabilistic models to represent it in principle.

One might also worry that this primitivist account of objective probability fails to meet the probability coordination criticism—roughly, that there does not seem to be anything about the notion of objective probability that warrants matching one's credences to it. But note that my view of objective probability is quite sparse. Only fundamentally stochastic behavior is considered sufficient for objective probability. If it is the case that irreducible stochastic dynamics exist in our world, scientific theories require a probability calculus to compute them. Thus, an ontological account of objective probability is acquainted with science in a particularly useful sort of way. And presumably, a perfectly rational subject, believing the best available

[6] Put another way, a frequency has nothing to do with the outcome of an individual die roll, whereas the physical dynamics that govern the die roll have everything to do with the outcome.

scientific theory, will *ipso facto* match her credences using the only sort of mathematics available to describe stochastic phenomena in scientific models: probability.

Conversely, on a primitivist conception of objective probability that does not require exclusively stochastic dynamics, it is unclear why a rational agent should believe that an individual particle has, say, a 50% chance of jumping to a higher or lower energy state as designated by statistical mechanics. The scientific model can just as well (though in much more complicated fashion) state statistical mechanics in terms of concrete deterministic models, correctly implying that the chance for the individual particle to be excited or grounded is actually 0 or 1. In this case our rational agent has no reason to match her credence according to the probabilistic model of statistical mechanics, crucially because the model is a frequency. It has nothing to say about the energizing of an individual particle, whereas the deterministic models have everything to say about the individual particle. To state the original point once more: if there are irreducible stochastic dynamics, then the probabilistic equations required to model them scientifically will have everything to say about the activities of, for example, the decay rate of carbon-15. And if scientific models of objective probabilities convey truth, as they presumably do in principle, a rational subject will be required to match her credences to the objective probabilities.[7]

[7] Strevens (1999) presents an alternate version of the probability coordination problem according to which knowing that objective probabilities will behave properly in the future is a special case of the problem of induction. Thus, matching one's subjective probabilities to the objective probabilities is unjustifiable. This argument is worrying, and quite hard to refute, but the conclusion does not seem to warrant the complete rejection of objective probability, no more than the problem of enumerative induction for science warrants ending the practice of the scientific method.

References

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