Philosophy 304

How probability begets belief

Topic #3

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In *An Inquiry Concerning Human Understanding*, David Hume argues strongly against our ability to know a great many things for certain. Other than facts which are known to us from past experience, or mathematical truths, we cannot know anything about future events, or true metaphysical states of the universe, particularly those that apply to forces, or cause and effect. Indeed, Hume argues that cause and effect is essentially an appearance, and future events cannot be known to follow from past similar events.

However, Hume does suggest that we can *believe* something about future events (as opposed to *know*) based on past experience. For he says that :

> If we allow that belief is nothing but a firmer and stronger conception of an object than what attends the mere fictions of the imagination, this operation may, perhaps, in some measure be accounted for. (Hume 70).

In other words, if we see an event attend upon another a number of times, then we will begin to expect, to *believe*, that the event we have seen so often in the past will happen yet again. And that our belief will be roughly proportional to the number of times those events have occurred together vs. when they have not, as in the manner of a probability, since, from our perspective, we cannot tell the difference between chance events and events which are otherwise (and unpredictably) related by their, in Hume's mind, accidental occurrence together and having the appearance of cause and effect. Because we cannot tell the difference, in our minds we treat them identically: as probabilities. (Hume 71)

The strength of our beliefs depends on the strength of the probabilities, and thus the number of times the event has occurred relative to the number of times it has failed to occur. (Hume 71) If an event occurs repeatedly and apparently without fail in the past, our belief will

be quite strong that the same event, or combination of events, will again occur under the same circumstances. However, if we have a number of possible outcomes for a given situation, as with rolling a die, our expectation, or *belief*, in a given outcome will be considerably lower.

Consider the case of the sun rising in the morning. We know from past experience that the sun rises every day, and has done so all the days of our lives that we can remember. Indeed, we know from talking the others and recorded information going back as long as history has been written, that there are no exceptions to this rule. (Even if one believes the Biblical story in Joshua 10:13, that the sun and moon stopped in the course of their movement, there is but a single exception.) Even in a single human lifetime, we may ourselves witness 28,000 such sunrises. Because of this tremendously consistent track record, we can say with *nearly* complete confidence that the sun will indeed rise in the morning. Because this is a future event, we cannot know *for certain*, but our belief is incredibly strong because we assess the probability of this event failing to happen to be quite close to zero, indeed, something like 99.996487% certain ($(\frac{78\times365-1}{78\times365})^1$. Modern science takes a position very similar to this, despite disagreeing with Hume on cause and effect, but science reaches its probabilistic conclusions from a slightly different source. Knowing that the sun rises because the Earth turns and our position to the sun changes, it is still possible to conceive of the sun not rising tomorrow. There may be ways to make the Earth stop turning, or in theory, to remove the Earth from the vicinity of the Sun altogether, à la Dr. Who, that would have the effect of the sun failing to rise in the morning. (Whether we would still be here in the morning to notice or care

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[1] I am assuming a human lifespan of 78 years, and 365 days a year, and one exception. This is a simplistic calculation, but should be sufficient for the point. A Bayesian model would probably be more appropriate for what Hume has in mind, but certainly that is beyond the scope of this paper.

after such a cataclysmic event as is necessary according to modern science is another matter altogether.) However, these events are incredibly unlikely, and so while the scientist might insist he "knows", barring these extraordinary events, he nonetheless "believes" in the manner of Hume, in a strictly probabilistic sense; he just *believes* very strongly.

In the case of believing that it will be above 80 on average in August 2010, our belief is still strong, but not as certain as our belief that the sun will rise tomorrow. For one thing, there are many fewer Augusts to draw on in our memories, even if we live here our whole lives, or even on record, from which to calculate a probability. Because of that, any single deviation from the norm will loom much larger than a single failed sunrise, long ago in the distant past. Indeed, even one August in a single lifetime that fails to average above 80 generates a probability of approximately 98.7179% ($\frac{77}{78}$)^2. We may also draw on our experience of other summer months in recent years where the temperature was unseasonably cool. Our beliefs in such an event, that it will average above 80 in Columbus in August, is strong enough that we may be willing to make plans based on that event, and argue for it in debate, and even, perhaps, be willing to bet money on the likelihood; however, would one be willing to stake one's life on such a belief? Our beliefs that the sun will rise tomorrow are so strong, that we probably would consider it an easy risk, with so little likelihood of failing to occur that there is no real risk at all. But for the case of a warm August, we are confident in our beliefs, but not quite so much so.

In the case of Professor Shabel showing up for the final exam, if we have this belief at all, we may hold it very tentatively indeed. Since I have never had a class with Professor Shabel

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[2] Assuming a lifespan of 78 years, and one exception.

before, I don't know what her particular habit is, but even if I had seen it happen before, I might question why she would bother with two TAs to take over for her (although, for Hume, these facts are unconnected). Or, I might have seen it happen sometimes, and not other times. The deviation, then, from perfect consistency, and lacking the number of occurrences that might firmly establish the belief in my mind, causes me to hold such a belief, if I hold one at all, very tentatively. I would not be surprised greatly in either event, that Professor Shabel shows up, or if she does not, even if I conclude, ultimately, that she will.[3]

This notion of how the strength of our beliefs are held in proportion to the probabilities associated with those beliefs seems to be intuitively realistic and conforms to our common sense ideas. When we are given no information about an event other than its occurrence or failure of occurrence without cause-and-effect information (since Hume believes there is no such thing) (Hume 44), and we are compelled to look at the world as a kind of black box into which we cannot peer, even the numbers themselves seem plausible. However, in a universe where cause and effect is real and knowable, even in some sense, then additional information can be used to determine probabilities associated with our beliefs because we can bring additional information to bear on a question, and to drive the probabilities in the direction of near certainty (as with the sun rising in the morning), or in the direction of uncertainty (as with having a warm August this year). It is here where Skepticism, and the Empiricism of modern

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[3] To get above 50% mark, one would need 3 events, two of which turned out the same. Even so, 66.6667% is not a very strong probability.

science, fail to meet, and it is here where Hume's conclusions about future events will seem

unnecessarily tentative.[4]

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[4] Of course, Hume will find more sympathy among those afraid to fly, since they, too, don't trust past experience nor science, and expect their plane to fall out of the sky at any minute,