Primer for White's 'Fine-tuning and multiple universes'

PHIL 13195 — Jeff Speaks — September 25, 2007

One of the things which makes this paper difficult to follow is the unfamiliar notation used for expressing statements about probability. Here is a rough summary of this:

P(H)

You can read this as 'the probability of H.' In this paper, this refers to subjective probability: the probability that someone assigns to a given claim. What does it mean to assign probability to a claim? One rough way to understand this is in terms of bets. Suppose that you would take a bet on H at better than even odds, but no worse. (So if someone came up to you and say, "I bet you my $5 to your $4 that H is false", you'd say, OK; but if someone came up to you and said, "I bet you my $4 to your $5 that H is false", you'd say, No. If someone came up to you and offered you an even odds bet that H is false, you could either take it or leave it; you'd think that the odds of your winning in that case would be the same as the odds of you losing.) In this case, it seems like you think that the chances of H being true are 50%. The way you write this in the notation of this paper is

P(H)=0.5

We also want to be able to talk about the probabilities of some claims, given that certain other claims are true. So, for example, let

H = The Cubs will win the World Series in 2007.

Then maybe you say that

P(H)=0.3

But now suppose I ask you what the odds are that the Cubs will win the Series if Alfonso Soriano gets hurt. What we are asking is a question about *conditional probability*: what would you say about the probability of H on the condition that you were given a certain new piece of *evidence* — in this case, the evidence is E:

E = Alfonso Soriano will get hurt.

So we are asking about the probability of a certain hypothesis H, given a certain piece of evidence E, and we write this as follows:

P(H|E)

(This is pronounced: 'the probability of H, given E.') Sometimes evidence will make the probability of a hypothesis go down (as in this case), and sometimes it will make it go up. Suppose we had different evidence, like

E* = A National League team will win the World Series.

Then, presumably, since the Cubs are in the National League,

$P(H|E^*) > P(H)$

Now, usually what we're interested in is not what somebody or other really does assign as the probability of a certain claim, but rather what we should rationally assign as the probability of a certain claim. However, it is not easy to see how we should answer a question like, 'What probability is it rational to assign to the claim that the Cubs will win the World Series this year?', because the answer to this question depends on what you know about the Cubs. Suppose you know only that the Cubs are a Major League team, and that every year one of the 30 Major League teams wins the World Series. Given this *background knowledge*, it would be rational for the probability you assign to H to be $\frac{1}{30}$. But suppose you know that the Cubs are one of the relatively few teams who still have a chance to make the playoffs; then, relative to (i.e., *conditional on*) this background knowledge, the odds you should rationally assign should be substantially higher.

So, typically, claims about what probability we should assign to a given hypothesis are best understood as claims about what conditional probability we should assign to a given hypothesis, given certain background knowledge.

This way of setting things up allows us to express the idea that a certain piece of evidence *confirms*, or *counts in favor of*, a given hypothesis. We say that evidence E confirms hypothesis H relative to background knowledge K if and only if

$P(H|E \,\&\, K) > P(H|K)$

As White notes (P1, p. 261), the fact that E confirms H in this sense is equivalent to the claim that, given K, E would be more likely to be true if H were true than if H were false. The intuitive idea here is that evidence confirms a hypothesis if and only if the evidence makes the hypothesis more likely to be true; but also that evidence confirms a hypothesis if and only if the hypothesis says that the evidence is quite likely to be true, and it is. (Think about the predictions of scientific theories; if a scientific theory says that it is very likely that we will find a certain piece of evidence, and we do, we think that that tends to confirm the theory.) So we can state the following equivalence (this is White's P1):

$P(H|E \,\&\, K) > P(H|K)$ is equivalent to $P(E|H \,\&\, K) > P(E|\text{not-}H \,\&\, K)$

Here are some questions you should try to answer when working through this paper:

- Why does White say (p. 262) that E does not confirm M, but that E' does? What does this have to do with the 'inverse gambler's fallacy'?
- What does White mean when he says that E' is weaker than E? Why is this relevant?
- How is it possible, according to White, for a hypothesis to make evidence less surprising even when the evidence does not confirm the theory?