Updating by Conditionalization

We have considered a constraint on rational belief: that one's credence function internally coherent; and, more specifically, that it be a probability function. Notice, however, that this doesn't tell us anything about what it takes for one to update one's beliefs in a rational way, as one acquires additional information. That will be the topic of this subsection.

Just like one might use an *unconditional* probability function $p\left(A\right)$ to talk about the probability of A, so one could also use a *conditional* probability function $p\left(A|H\right)$ to talk about the probability of A *on the assumption that* H *obtains*. Suppose, for instance, that S thinks it's unlikely to rain: $p\left(\text{Rain}\right) = 0.2$. She thinks its even less likely that there'll be a sudden drop in atmospheric pressure: $p\left(\text{Drop}\right) = 0.1$. But S also thinks there's a strong correlation between rain and sudden pressure drops. In particular, she is confident to degree 0.95 in the following conditional statement: it'll rain, *assuming there's a sudden drop in atmospheric pressure*. We can then say that S's *conditional* credence in rain given a pressure drop is 0.95; in symbols: $p\left(\text{Rain}|\text{Drop}\right) = 0.95$.

The notion of conditional credence puts us in a position to give an attractive answer to the question of what it takes for a subject to *update* her credences in a rational way, as she acquires additional information:

> **Update by Conditionalization**
> If S is rational, she will update here credences as follows upon learning that B:
>
> $$p^{new}\left(A\right) = p^{old}\left(A|B\right)$$
>
> where p^{old} is the function describing S's credences before she learned that B, and p^{new} is the function describing her credences after she learned that B.

Suppose, for example, that S starts out fairly confident that it won't rain: $p^{old}\left(\text{Rain}\right) = 0.1$. But she is highly confident that it'll rain, given that there's a sudden pressure drop: $p^{old}\left(\{\text{Rain}\}|\{\text{Drop}\}\right) = 0.95$. Now suppose that S learns that there's been a sudden

pressure drop. How confident should she be that it'll rain, in light of the new information. According to Update by Conditionalization, she should be highly confident: $p^{new}\left(\text{Rain}\right) = 0.95$.

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