Under what requirements will Bayes' Theorem be meaningful?

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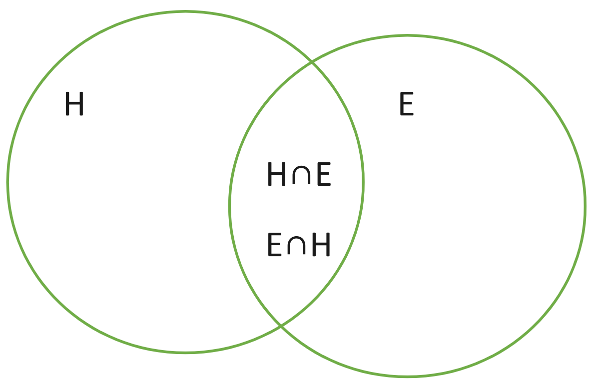
We establish that all the pertinent elements of an assertion must be real. That if it contains an element M which cannot be classified as real, we say that the assertion is contaminated. We then show that Bayes' Theorem is invalid.

Bayes' Theorem states the following:

$$P(H \mid E) = \frac{P(E \mid H)\,P(H)}{P(E)}$$



Proof

$$P(H \mid E) = \frac{P(H \cap E)}{P(E)}$$

$$P(E \mid H) = \frac{P(E \cap H)}{P(H)}$$

Since $$P(H \cap E) = P(E \cap H)$$

Therefore $$P(H \mid E)P(E) = P(E \mid H)P(H)$$

Rearranging,

$$P(H \mid E) = \frac{P(E \mid H)\,P(H)}{P(E)}$$

Consider the assertion H. We say that every pertinent element of H must be real.

Take H = my next-door neighbor has killed his wife. It has 3 pertinent elements:

1) My next-door neighbor must be real – if you live on an island, all by yourself, then H is meaningless;

2) He must have a wife – an imaginary wife in the case that he is delusional makes H meaningless;

3) And killing is an event that happens in real space and time.

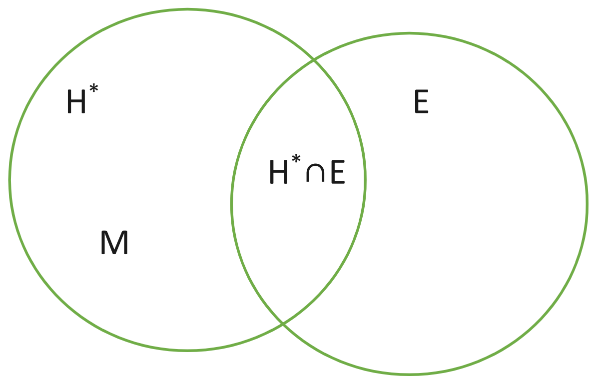
If every element of H is real, then we can proceed to P(H): calculate or estimate what is the probability that my next-door neighbor has killed his wife?

The same rigorous requirements we have applied on H must be applied on the evidence E, that is, all the pertinent elements contained in E must be real. That humans can pass through solid walls might be true in the world of Star Trek™, but not real in our world. Once all the pertinent elements of E have been established as real, only then can we proceed with P(E). Assume that there is a reasonable way to calculate or estimate these probabilities and their conditional probabilities, then BT can make sense.

Now suppose there is an event, called it M, that is in dispute as to whether it is real or not. It could be real but also magical, supernatural or even fictional, whatever the case may be, if H or E contains M as a pertinent element, then we say that BT is invalid. The reason is that whatever the disagreement about M is, the chances are that it will be also contained in BT. IOW, the BT will not settle the disagreement concerning the real nature of M. That disagreement will have to be settled outside the BT.

Proof:

If H contains M, we say it is contaminated, and $H \rightarrow H^*$



Proof

$$P(H^* \mid E) = \frac{P(H^* \cap E)}{P(E)}$$

$$P(E \mid H^*) = \frac{P(E \cap H^*)}{P(H^*)}$$

Since $$P(H^* \cap E) = P(E \cap H^*)$$

Therefore $$P(H^* \mid E)P(E) = P(E \mid H^*)P(H^*)$$

Rearranging,

$$P(H^* \mid E) = \frac{P(E \mid H^*)\,P(H^*)}{P(E)}$$

Similarly, if E is contaminated, then E → E*, and

$$P(H \mid E^*) = \frac{P(E^* \mid H)\,P(H)}{P(E^*)}$$

Note: it matters not where M is placed in the Venn diagram.

We conclude that only if all the pertinent elements are real, then the use of Bayes' Theorem is valid. If either H or E is contaminated, that is, either one contains an element M, which may be real or not, then Bayes' Theorem will also contain M, and its result will be inconclusive. And so the applicability of Bayes' Theorem in that case is invalid.