

Don replied to Andrew this way:

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Since I believe in a God of order, whom I believe would create a very elegant universe, the experimental discoveries supporting a moderately simple Standard Model of Particle Physics (even though we hope for an even simpler ultimate theory) have increases my posterior belief in God, as has the cosmological data supporting the Standard Model of Cosmology (though here I also hope for an even simpler multiverse model).

On the other hand, all sorts of logically possible but crazy things would decrease my posterior belief, such as CERN not being able to reproduce any evidence for the Higgs boson next year, seeing electrons decay into uncharged particles with a lifetime much less than the current lower limits, not being able to see distant stars any more, and on and on with all sorts of things that could be different if God did not continue to run the universe in the orderly way He does now.

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What Don says here would make him more sure of the existence of a god would make me less sure, since physics predicts what it does and that's what we observe.

Suppose we have, as Don imagines, a collection of possible pieces of observational evidence

$$E=\{E1, E2, \dots\}$$

that we might make, some of which are consistent with the hypothesis

$$Q=\text{"physics is all there is"}$$

and some of which are inconsistent with Q but consistent with the alternative hypothesis

$$R=\text{"physics is not all there is"}$$

The possible pieces of evidence that Don imagines include some that are consistent with Q and some that are inconsistent with Q. If Q is true, we can be certain that any piece of evidence  $E_k$  that we happen to observe will be consistent with Q:

$$P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is consistent with } Q \mid Q) = 1$$

whereas we can be sure that that piece of evidence is not inconsistent with Q:

$$P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is inconsistent with } Q \mid Q) = 0$$

Having observed any random  $E_k$ , this is the likelihood that we will determine that it is consistent with Q, given that "physics is all there is".

But suppose R is true. Suppose we happen to observe a particular  $E_k$ . What is the probability that we will determine that it is inconsistent with Q? Could it still be observed, given that R is true? The answer is "yes," if we hypothesize that R entails the existence of a god that is omnipotent and therefore capable of making anything happen that it wishes (such as resurrections and other miracles, for example, that are contrary to physical law).

Therefore we have the following likelihood under the alternative hypothesis:

$$P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is inconsistent with } Q \mid R) > 0$$

and

$$P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is consistent with } Q \mid R) < 1$$

since we can be sure that the  $E_k$  that we happen to observe is either consistent with Q or inconsistent with Q so these probabilities add to 1:

$$P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is consistent with } Q \mid R) + P(\text{Having observed } E_k, \text{ we determine that } E_k \text{ is inconsistent with } Q \mid R) = 1$$

Now that we have a likelihood model in hand, we can compute the likelihood ratio upon happening to observe a piece of data  $E_k$  that we then determine is consistent with Q:

$$\frac{P(\text{Having observed } E_k \text{ we determine that } E_k \text{ is consistent with } Q \mid Q)}{P(\text{Having observed } E_k \text{ we determine that } E_k \text{ is consistent with } Q \mid R)} > 1$$

That is, every time that we observe a piece of evidence  $E_k$  that is consistent with the hypothesis that "physics is all there is," we find that it supports "physics is all there is" and undermines the alternative hypothesis that includes an omnipotent god (or for that matter, even a semi-powerful god that is capable of subverting physical law on some occasions).

Alternatively, every time we observe a piece of evidence  $E_k$ , we can compute the likelihood ratio that we will observe it to be inconsistent with Q:

$$\frac{P(\text{Having observed } E_k \text{ we determine that } E_k \text{ is inconsistent with } Q \mid Q)}{P(\text{Having observed } E_k \text{ we determine that } E_k \text{ is inconsistent with } Q \mid R)} = 0$$

In other words, observing just a single piece of evidence, a single miracle, the Resurrection, for example, does not merely undermine the hypothesis that physics is all there is, it refutes it.

From a Bayesian point of view, regardless of your choice of prior probabilities of  $P(Q)$  and  $P(R)$ , Bayes' theorem tells us that as we continue to observe more and more data, each piece of which is consistent with  $Q$ , then the posterior odds ratio simply gets larger and larger, and regardless of your choice of prior, the posterior probability of "physics is all there is" approaches 1.

So I am mystified by Don's comment that observing more and more data that is only consistent with what physics says we should observe makes him more confident of the existence of a god, whereas observing data inconsistent with physics would make him doubt the existence of god. It seems to me he's got it entirely backward.

Now it may be that the god that Don believes in only produces results that are consistent with  $Q$ , and that Don's god eschews miracles, the god of deism if you will, who does not meddle with the universe. If this is what Don believes, then the likelihoods corresponding to his god are identical to those under  $Q$ , that is, 1 if  $E_k$  is consistent with  $Q$  and 0 otherwise; in that case, all the likelihood ratios are 1, the posterior probabilities after observing a ton of data that are all consistent with  $Q$  is identical to the prior probabilities, and one learns nothing about the existence of that god regardless of how much data is observed. So even there, Don's comment mystifies me.

See here:

<http://bayesrules.net/anthropic.html>

...which was published in "The Improbability of God," edited by Michael Martin and Rickie Monnier (starts on p. 150)