

THINKING TOOLS: YOU CAN PROVE A NEGATIVE

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Thinking Tools is a regular feature that introduces tips and pointers on thinking clearly and rigorously.

A principle of folk logic is that one can't prove a negative. Dr. Nelson L. Price, a Georgia minister, writes on his website that 'one of the laws of logic is that you can't prove a negative.' Julian Noble, a physicist at the University of Virginia, agrees, writing in his 'Electric Blanket of Doom' talk that 'we can't prove a negative proposition.' University of California at Berkeley Professor of Epidemiology Patricia Buffler asserts that 'The reality is that we can never prove the negative, we can never prove the lack of effect, we can never prove that something is safe.' A quick search on Google or Lexis-Nexis will give a mountain of similar examples.

But there is one big, fat problem with all this. Among professional logicians, guess how many think that you can't prove a negative? That's right: zero. Yes, Virginia, you *can* prove a negative, and it's easy, too. For one thing, a real, actual law of logic *is* a negative, namely the law of non-contradiction. This law states that that a proposition cannot be both true and not true. Nothing is both true and false. Furthermore, you can *prove* this law. It can be formally derived from the empty set using provably valid rules of inference. (I'll spare you the boring details). One of the laws of logic is a provable negative. Wait... this means we've just proven that it is *not* the case that one of the laws of logic is that you can't prove a negative. So we've proven yet another negative! In fact, 'you can't prove a negative' is a negative — so if you could prove it true, it wouldn't be true! Uh-oh.

Not only that, but *any* claim can be expressed as a negative, thanks to the rule of double negation. This rule states that any proposition P is logically equivalent to not-not-P. So pick anything you think you can prove. Think you can prove your own existence? At least to your own satisfaction? Then, using the exact same reasoning, plus the little step of double negation,

you can prove that you aren't nonexistent. Congratulations, you've just proven a negative. The beautiful part is that you can do this trick with absolutely any proposition whatsoever. Prove P is true and you can prove that P is not false.

Some people seem to think that you can't prove a specific sort of negative claim, namely that a thing does not exist. So it is impossible to prove that Santa Claus, unicorns, the Loch Ness Monster, God, pink elephants, WMD in Iraq, and Bigfoot don't exist. Of course, this rather depends on what one has in mind by 'prove.' Can you construct a valid deductive argument with all true premises that yields the conclusion that there are no unicorns? Sure. Here's one, using the valid inference procedure of *modus tollens*:

1. If unicorns had existed, then there is evidence in the fossil record.
2. There is no evidence of unicorns in the fossil record.
3. Therefore, unicorns never existed.

Someone might object that that was a bit too fast — after all, I didn't prove that the two premises were true. I just asserted that they were true. Well, that's right. However, it would be a grievous mistake to insist that someone prove all the premises of any argument they might give. Here's why. The only way to prove, say, that there is no evidence of unicorns in the fossil record, is by giving an argument to that conclusion. Of course one would then have to prove the premises of *that* argument by giving further arguments, and then prove the premises of those further arguments, *ad infinitum*. Which premises we should take on credit and which need payment up front is a matter of long and involved debate among epistemologists. But one thing is certain: if proving things requires that an infinite number of premises get proved first, we're not going to prove much of anything at all, positive or negative.

Maybe people mean that no *inductive* argument will conclusively, indubitably prove a negative proposition beyond all shadow of a doubt. For example, suppose someone argues

that we've scoured the world for Bigfoot, found no credible evidence of Bigfoot's existence, and therefore there is no Bigfoot. A classic inductive argument. A Sasquatch defender can always rejoin that Bigfoot is reclusive, and might just be hiding in that next stand of trees. You can't prove he's not! (until the search of that tree stand comes up empty too). The problem here isn't that inductive arguments won't give us certainty about negative claims (like the nonexistence of Bigfoot), but that inductive arguments won't give us certainty about anything at all, positive or negative. *All observed swans are white, therefore all swans are white* looked like a pretty good inductive argument until black swans were discovered in Australia.

The very nature of an inductive argument is to make a conclusion probable, but not certain, given the truth of the premises. That's just what an inductive argument is. We'd better not dismiss induction because we're not getting certainty out of it, though. Why do you think that the sun will rise tomorrow? Not because of observation (you can't observe the future!), but because that's what it has always done in the past. Why do you think that if you turn on the kitchen tap that water will come out instead of chocolate? Why do you think you'll find your house where you last left it? Why do you think lunch will be nourishing instead of deadly? Again, because that's the way things have always been in the past. In other words, we use inferences — induction — from past experiences in every aspect of our lives. As Bertrand Russell pointed out, the chicken who expects to be fed when he sees the farmer approaching, since that is what had always happened in the past, is in for a big surprise when instead of receiving dinner, he becomes dinner. But if the chicken had rejected inductive reasoning altogether, then every appearance of the farmer would be a surprise.

So why is it that people insist that you can't prove a negative? I think it is the result of two things. (1) an acknowledgement that induction is not bulletproof, airtight, and infallible, and (2) a desperate desire to keep believing whatever one believes, even if all the evidence is against it. That's why people keep

believing in alien abductions, even when flying saucers always turn out to be weather balloons, stealth jets, comets, or too much alcohol. You can't prove a negative! You can't prove that there are no alien abductions! Meaning: your argument against aliens is inductive, therefore not incontrovertible, and since I want to believe in aliens, I'm going to dismiss the argument no matter how overwhelming the evidence against aliens, and no matter how vanishingly small the chance of extraterrestrial abduction.

If we're going to dismiss inductive arguments because they produce conclusions that are probable but not definite, then we are in deep doo-doo. Despite its fallibility, induction is vital in every aspect of our lives, from the mundane to the most sophisticated science. Without induction we know basically nothing about the world apart from our own immediate perceptions. So we'd better keep induction, warts and all, and use it to form negative beliefs as well as positive ones. You *can* prove a negative — at least as much as you can prove anything at all.

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