

False white swans

The common example given for falsification, “All swans are white,” is not an example and its use is misleading everyone, philosopher and layperson alike.

How can you tell if a theory is scientific? According to philosopher Karl Popper, to be scientific it must be “falsifiable.” That is, unless there exists some test which could show the theory is wrong, it is *not* scientific. He points to the asymmetry between proof and disproof, in that a theory can never be conclusively proved correct no matter how much confirming evidence there is but a single refuting example will disprove it.

As examples of non-science, Popper mentions Marxist theory and Freudian theory which like to claim they are scientific but, since there is no way to disprove them, aren’t. This is not to say the Marxists and Freudians know nothing; humans have known things for millions of years. The point is to understand just what it is that distinguishes *scientific* knowledge, the knowledge that, over the last four centuries, has transformed human life.

There is a mountain of ivory tower argument over “falsificationism” but in ordinary science it is routine practice, as research papers are published and exposed to falsification by peers. In addition, every technological application—every engine started, every drug taken—has potential to falsify the theories which helped make it. Falsificationism has always operated on practical science and Popper put his finger on it.

Popper discusses another example of falsifiability: the claim, “All swans are white.” Can we prove all swans are white? No: proof is not possible for we can never be sure we have examined all swans. On the other hand a single example of a black swan would definitely disprove it. A couple of centuries ago, Europeans would have assumed the assertion was true and then, of course, they saw black swans and so it was falsified.

Or was it?

Almost everyone who explains or teaches the idea of falsifiability uses the example of “All swans are white.” The English Wikipedia page even has a picture of black swans. It seems like a nice, simple way to convey the concept. But it is not simple; it is simplistic. As an example of falsifiability in science, “All swans are white” is faulty and—what really matters—its use by philosophers of science is distorting the understanding of science.

Here’s what’s wrong with it:

(a) The colour of swans has nothing to do with science; a caveman could have said it. The point of falsifiability is that it is supposed to be a marker of *science*; the example is irrelevant. Why use it? Is there a shortage of genuine

scientific theories? In the myriad examples of its (mis)use, no one gives any reasons for substituting a claim about swans for a scientific theory—and that means it is being used thoughtlessly. Thoughtlessness is philosophy’s biggest sin.

(b) Falsification is supposed to apply to a *theory*. “All swans are white” is not a theory; it is an empirical assertion. “All grass is green” and “All lawyers are scoundrels” and “All swans are long-necked” are not theories—though these assertions are falsifiable, requiring only a single example of blue grass, an honest lawyer, and a short-necked swan. Why don’t philosophers explain why they use a non-theory instead of a theory? Could it be that they haven’t noticed the difference?

(c) Science theories do not begin with “All...” No one says, “All force equals mass times acceleration.” Why introduce this odd construction as if it were typical of science theorising? Why do philosophers think the form “All A is B” stands for a scientific theory? Why does no one offer an explanation? Perhaps it is a product of their preconceptions, which would be a sort of thoughtlessness.

(d) Science theories (hypotheses, models, laws) do not state properties, such as “white;” in general, they do not employ the verb to be. A science theory does not state a concept’s *being*; it states its relationship to another concept. A science law *does*, rather than *is*. Are philosophers of science aware of this? As far as I can tell, they are not.

(e) Lone concepts (such as “swan”) do not exist in science theory. A scientific theory expresses a relationship between two or more concepts. For example, force equals mass times acceleration; phenotypes vary so those best fitted to their environment will reproduce more.

(f) No doubt the first Englishman to see those black creatures called them swans. Their blackness is not paint; it comes from their genes which means they are a different animal from swans. Strictly speaking, the so-called black swans can no more falsify the claim that “all swans are white” than can black rhinoceroses.

(g) Popper, the original cause of all this confusion, discusses the dodge of defining swans as white in order to protect the claim from falsification. And of course that would be illegitimate for a definition is an opinion and a science theory describes the natural world which has nothing to do with human opinion.

But he got it back to front. I am not protecting; the onus is on the falsifier to falsify, not on me to defend. It is not up to *me* to define “swan” as white in a cunning ploy to evade falsification; any defining is the responsibility of the would-be falsifier. In order to falsify the claim, the falsifier must show—not thoughtlessly assume—that the black creature is a swan. Perhaps, despite my reservations, those black animals really are swans. How can the falsifier show this? It seems the only possibility would be to define “swan.” Of course, no one attempts this for if they did, it would make both the claim and its falsification dependent upon a definition.

The fact that Popper felt he had to address the matter of definition should have been a red flag. Has any science theory ever been refuted, or avoided refutation, by manipulating definitions? He was wandering in a land foreign to science because his white swans were not in the land of science.

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The black swan has become a household word; it encapsulates surprise and enjoins us to be cautious with our assumptions. However, the use of “All swans are white” fails the task of showing that falsifiability is a marker of science. Had philosophers adopted a genuine example, they might have noticed that a science theory does not describe a concept’s property. That itself could be a marker of science. They might have noticed that a science theory never deals with a lone concept but always expresses a relationship between concepts. That, too, might be a marker.

Popper’s concept of falsifiability was a big advance in the understanding of what makes science, science. It zeroes in on a major difference between science and ideology, science and confabulation. It says, in effect, that if you want to persuade me of your theory, you should indicate what you would accept as refuting your theory. Unless you do that, you are not playing fair, for you are wanting to convince me but are insulating yourself against my convincing you.

Misidentification of species is common even among experts and just because that first Englishman called the black creatures “swans,” doesn’t mean philosophers should follow his lead. Indeed, it is the duty of philosophy to question the things the rest of us take for granted. By failing to do that in this case, philosophers are throwing sand in everyone’s eyes, blinding themselves and their students to other distinguishing properties of science theory.□

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