Baloney Detection

How to draw boundaries between science and pseudoscience, Part I

By MICHAEL SHERMER

When lecturing on science and pseudoscience at colleges and universities, I am inevitably asked, after challenging common beliefs held by many students, "Why should we believe you?" My answer: "You shouldn't."

I then explain that we need to check things out for ourselves and, short of that, at least to ask basic questions that get to the heart of the validity of any claim. This is what I call baloney detection, in deference to Carl Sagan, who coined the phrase "Baloney Detection Kit." To detect baloney—that is, to help discriminate between science and pseudoscience—I suggest 10 questions to ask when encountering any claim.

1. How reliable is the source of the claim?

Pseudoscientists often appear quite reliable, but when examined closely, the facts and figures they cite are distorted, taken out of context or occasionally even fabricated. Of course, everyone makes some mistakes. And as historian of science Daniel Kevles showed so effectively in his book *The Baltimore Affair,* it can be hard to detect a fraudulent signal within the background noise of sloppiness that is a normal part of the scientific process. The question is, Do the data and interpretations show signs of intentional distortion? When an independent committee established to investigate potential fraud scrutinized a set of research notes in Nobel laureate David Baltimore's laboratory, it revealed a surprising number of mistakes. Baltimore was exonerated because his lab's mistakes were random and nondirectional.

2. Does this source often make similar claims?

Pseudoscientists have a habit of going well beyond the facts. Flood geologists (creationists who believe that Noah's flood can account for many of the earth's geologic formations) consistently make outrageous claims that bear no relation to geological science. Of course, some great thinkers do frequently go beyond the data in their creative speculations. Thomas Gold of Cornell University is notorious for his radical ideas, but he has been right often enough that other scientists listen to what he has to say. Gold proposes, for example, that oil is not a fossil fuel at all but the by-product of a deep, hot biosphere (microorganisms living at unexpected depths within the crust). Hardly any earth scientists with whom I have spoken think Gold is right, yet they do not consider him a crank. Watch out for a pattern of fringe thinking that consistently ignores or distorts data.

3. Have the claims been verified by another source?

Typically pseudoscientists make statements that are unverified or verified only by a source within their own belief circle. We must ask, Who is checking the claims, and even who is checking the checkers? The biggest problem with the cold fusion debacle, for instance, was not that Stanley Pons and Martin Fleischman were wrong. It was that they announced their spectacular discovery at a press conference before other laboratories verified it. Worse, when cold fusion was not replicated, they continued to cling to their claim. Outside verification is crucial to good science.

4. How does the claim fit with what we know about how the world works?

An extraordinary claim must be placed into a larger context to see how it fits. When people claim that the Egyptian pyramids and the Sphinx were built more than 10,000 years ago by an unknown, advanced race, they are not presenting any context for that earlier civilization. Where are the rest of the artifacts of those people? Where are their works of art, their weapons, their clothing, their tools, their trash? Archaeology simply does not operate this way.

5. Has anyone gone out of the way to disprove the claim, or has only supportive evidence been sought?

This is the confirmation bias, or the tendency to seek confirmatory evidence and to reject or ignore disconfirmatory evidence. The confirmation bias is powerful, pervasive and almost impossible for any of us to avoid. It is why the methods of science that emphasize checking and rechecking, verification and replication, and especially attempts to falsify a claim, are so critical.

Next month in Part II I will expand the baloney detection process with five more questions that reveal how science works to detect its own baloney. SA

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