In 1947 the writer George Orwell asked himself why he thought the Earth was round and found that he could not advance any reliable evidence to prove it. After all, that a ship's masts appear on an ocean horizon before its hull only demonstrates that the Earth is curved, not round.

After considering other arguments for a round Earth, Orwell ruefully concluded, “It would seem that my reasons for thinking that the earth is round are rather precarious ones. They do not rest on reasoning or on experiment, but on authority.” Of course most of us today have seen photographs of the Earth from space, but a photograph is not necessarily proof (as anyone with a computer and Photoshop software can attest). So, like Orwell, many of us might also be forced to admit that we believe in a round Earth because people have told us so.

Yet if this is the case, then our belief in a spherical Earth possesses no more validity than the existence of the Tooth Fairy. Enter the discipline of science, which involves a systematic gathering of information about the world and the organization of that information into testable laws and theories. To a scientific mind, reliable knowledge must be subject to some form of verification. In short, we can’t say we know something unless we can show how it is known.

Unfortunately, when it comes to an understanding of science and the way science works, most of us fail and fail miserably. Poll after poll demonstrates this. Indeed, a 2005 New York Times article reported that most Americans do not know what molecules are. Less than a third know that DNA is a key to heredity, and only 10 percent know what radiation is. Even more astonishing is that 20 percent of Americans believe the sun rotates the Earth, an idea discarded more then 300 years ago. So what accounts for our poor understanding of science? Bad teaching? Dull students?

Perhaps it has something to do with the nature of science itself. Indeed, he argues that human beings aren’t naturally wired to think scientifically and that good scientific thinking is often about as far from common sense as we can get. Consider Newtonian physics, for example. It deals with the laws of motion, which you would think obvious to everyone. After all, we observe objects in motion everyday. Even so, there is little intuitive about Newtonian physics.

Ask people what causes a ball to go up when they throw it, and most will say something like this: “The force of one’s throw causes it to rise, and the ball falls once that force is exhausted.” This was Aristotle’s idea 2,400 years ago. He, like most people, assumed the application of upward force on the ball is what causes it to rise. In fact, as Newton knew, the moment the ball leaves our hand the only operating force is the downward force of gravity. There is no force operating to raise the ball. As Newton stated it, objects in motion continue in motion unless acted upon by a retarding force. Without gravity, the ball would go forever. In this case, then, science is deeply counter-intuitive.

Science also deals with microscopic or macroscopic scales that are difficult to imagine. It is just too difficult for a lot of people to believe that we evolved from one-celled sea organisms, let alone ape-like ancestors. It would take far too many generations to evolve that dramatically. What they fail to understand is the immensity of the time involved. Overwhelming scientific evidence indicates the Earth is roughly 4.5 billion years old.

To put that time span into perspective, try to imagine it as a length of string with each foot representing 10 million years. To equal 4.5 billion years, our string would have to stretch one and a half football fields. Ten thousand years (roughly the time since the earliest organized human civilization appeared) would equal the thickness of a single sheet of paper. People just can’t accept that scale of time. It’s simple math, but on such a mind-boggling scale that most of us would never agree to its being true.

Another problem for science is the popular conception of truth. For most people, truth means a state of being absolutely proven. Of course, as the great philosopher of science Karl Popper pointed out, science never really proves anything. For example, most people understand that water freezes at 32 degrees Fahrenheit at sea level. Every time we have ever put this to the test it, we have gotten the same result. Popper, however, argued that we can only say that water freezing under these conditions is the
best theory we possess. After all, the water might not freeze the one-millionth time we test it. Popper put it this way: suppose that every swan ever observed was white. Would science then be justified in saying that it has proven that swans are white? No, all science could say is that no black swan has ever appeared. The possibility remains that one will someday.

Popper called this the falsification principle of science. In other words, science can never prove; it can only disprove. And in attempting to disprove, it provides an account for events as they exist now while remaining open to the possibility that new events may demand a modification of our view. In short, science is forever looking for the black swan.

This is why scientists are baffled by those who say evolution is just a theory. A theory, after all, is as good as it gets in science. There is no final knockdown proof of anything, only testable theoretical explanations for observable facts. That we catch cold from germs is also just a theory. Like all scientists, evolutionists have to examine the available facts and offer a theory that accounts for them in the most coherent and rational way. But here's the catch: if new reliable evidence appears, the theory has to be changed or even abandoned.

This was the case with the Ptolemaic theory of planetary orbits which put the Earth at the center of our galaxy. As a scientific theory, it wasn't all bad. It allowed astronomers to predict events in the heavens, but only by imagining a series of perfect circles upon which celestial objects rotated. The problem was that the mathematics needed to make this system cohere with observed data had grown increasingly complex by the end of the 15th century.

In order to make the theory match up with observed data, Astronomers posited 80 some perfect circles turning at varying rates. The problem was every time they found something new in the sky they had to add another circle. In short, the theory was reaching a kind of terminal complexity, and it seemed unlikely to Copernicus that God would make such an unlovely universe. So data was piled on data until someone finally said, “This doesn't add up. What would happen if we started with the crazy idea that the Sun is at the center?” When the theory no longer matches the data, there's only one thing you can do. Find a new theory.

Thus, a scientist's belief in any theory is never absolute; it's always provisional. It is merely what works until something better comes along. As a way of knowing, scientific thinking has much to recommend it. It demands keen observation, an ability to detect patterns, and to form rational hypotheses that account for these patterns. It also involves a strong commitment to the rational and systematic pursuit of truths in the physical world and remains a powerful tool for understanding the world in which we live.