It's in our hands.

Data Collection: the core of science

The foundation of the scientific method is the principle of empiricism (from the ancient Greek empeiria, experience): the theory that knowledge can only be gained through sensory impressions gathered by carrying out experiments and not through pure logic, intuition, revelation, or the like.

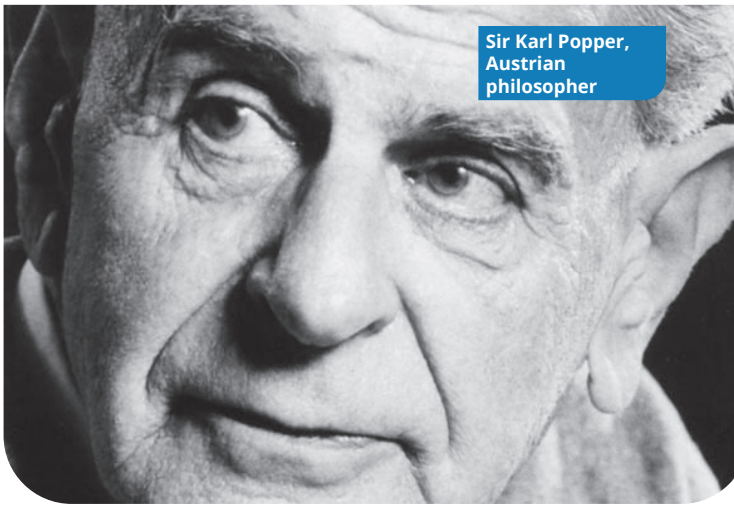
Scientists are only human, after all

It is important to collect data as neutrally, repeatably, and comparably as possible. Scientists are only human, after all, and tend to favor information that confirms their pre-existing worldview (so-called confirmation bias). There are a number of methods used to counteract this and other cognitive biases (e.g. the so-called double-blind study). Also, in order to have a basis for comparison, it is useful to have a control group. If you're carrying out a study to determine the effectiveness of a new drug, for example, in addition to the test group that receives the new drug, it's important to have a control group that doesn't. The collected data then either agree with or contradict the hypothesis.

Scientists are only human

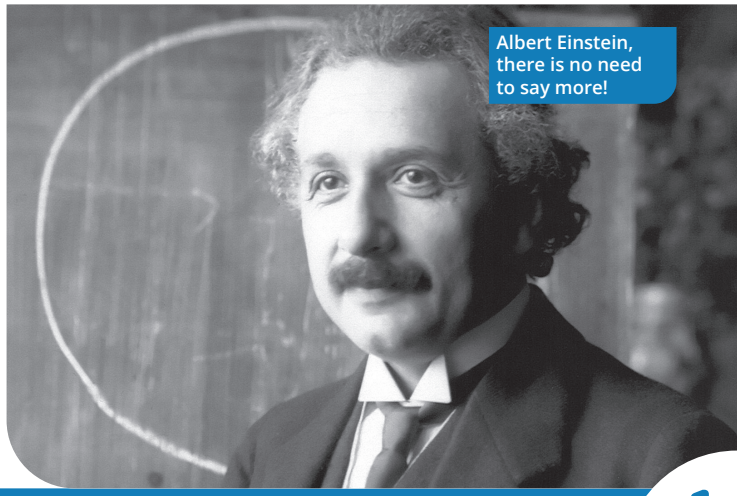
Science: a matter of philosophy?

However, according to the philosopher Karl Popper, a hypothesis can never really be proven, only disproven (or falsified). Even if one experiment confirms a hypothesis, further results (e.g. from yet unperformed experiments) might disprove the hypothesis after all.



Sir Karl Popper, Austrian philosopher

This principle is well summarized by Albert Einstein: *"The scientific theorist is not to be envied. For Nature, or more precisely experiment, is an inexorable and not very friendly judge of his work. It never says "Yes" to a theory. In the most favorable cases it says "Maybe", and in the great majority of cases simply "No". If an experiment agrees with a theory it means for the latter "Maybe", and if it does not agree it means "No". Probably every theory will someday experience its "No" – most theories, soon after conception.*



Albert Einstein, there is no need to say more!

It's in our hands.

Can you compare galaxies to sand?

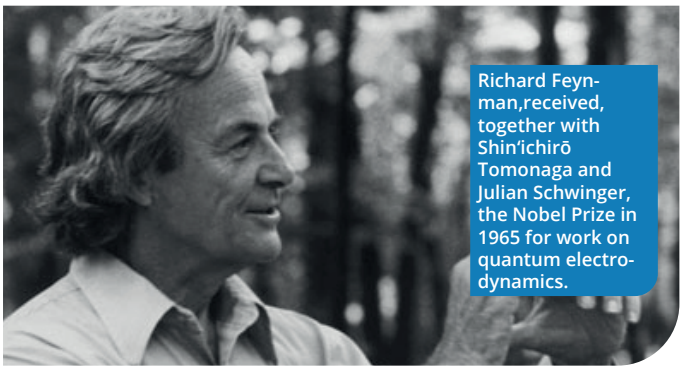
The mill of science grinds slowly, but extremely finely. By applying the method, we have succeeded in answering fundamental questions about the ways of the universe.

Some of these answers can be expressed in very elegant ways, so they describe many different phenomena (for example, the way the law of gravity equally describes the motions of grains of sand and clusters of galaxies).

According to the physicist Richard Feynman, Nature "uses only the longest threads to weave her patterns, so each small piece of her fabric reveals the organization of the entire tapestry."

The question is the beginning, and then comes the next question

Each new insight raises even more questions, of course. These new questions can then also only be answered with incremental additions to the knowledge already available. In the words of Isaac Newton, „If I have seen further it is by standing on the shoulders of Giants."



Richard Feynman,received, together with Shin'ichirō Tomonaga and Julian Schwinger, the Nobel Prize in 1965 for work on quantum electrodynamics.

Our Milky Way and Dunes of a Sand Desert