

Science is special

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On page 38 you'll find Matt Stanley's feature article, "Why should physicists study history?" To answer his own question, Stanley marshals an impressive and convincing set of arguments. I won't recapitulate them here, but I will echo one of them.

When you conceive an experiment or formulate a theoretical problem for the first time, the most you can know is what your predecessors have discovered. The only tools at your disposal are ones you make, buy, or borrow. By reading the history of science, you will gain insight into how Isaac Newton or other physicists from the past set out to tackle a problem with contemporary knowledge and tools, just like you.

Like other historians of science, Stanley emphasizes the human factor. Physicists work and deal with collaborators, editors, rivals, and funding managers. Although they strive to study the natural world objectively, they inevitably carry with them the assumptions and characteristics of their time and place. And whether they acknowledge it or not, physicists operate within social structures that allocate financial support, publish research, and bestow prizes.

But to what extent is physics, or science in general, a human activity? In his hostile *Wall Street Journal* review of Steven Weinberg's book *To Explain the World: The Discovery of Modern Science* (Harper Collins, 2015), historian of science Steven Shapin accuses Weinberg of falling victim to the historian's sin of looking at the past through the lens of the present. In particular, Shapin berates Weinberg for discounting Aristotle, René Descartes, and other thinkers of the past whose ideas about the nature of the universe turned out to be wrong in the light of subsequent discoveries. Science, says Shapin, "is not a self-evidently stable category."

But the natural phenomena that Aristotle and Descartes sought to explain have not changed either before or after the two men formulated their ideas. Astronomical observations tell us that gravity works the same way wherever we point our telescopes. The same chemical elements are present on Earth as they are on Mars or in the Andromeda galaxy. Whereas the methods and assumptions that scientists bring

to bear change through historical time, the object of their study, the natural world, is indifferent to scientists.

Shapin points out that the line between the natural and supernatural is fluid. In the minds of people past and present, it could well be. But the assertion comes close to claiming that what's natural or supernatural is wholly contingent on human belief. Granted, one is free to define those terms with reference to human psychology, but lightning, a phenomenon that people once attributed to gods, is and always has been a manifestation of atmospheric electricity.

Science is also special. Shapin calls it "modernity's reality-defining enterprise, a pattern of proper knowledge and of right-thinking." But then he goes on to liken that exalted status to that once occupied in the West by the Christian religion. But neither Christianity nor any other human endeavor has advanced as much as science has. In the centuries since Matsuo Basho (1644–94) died, has any other haiku poet clearly surpassed him in artistry? You may disagree that Johann Sebastian Bach (1685–1750) is the greatest composer of all time, but the opinion is a defensible one.

In 1781 James Madison and his fellow founders finished drafting the first US Constitution, the Articles of Confederation and Perpetual Union. That same year, William Herschel discovered Uranus. Whereas the current US Constitution is clearly superior to the unamended original, the leap from the six planets of Herschel's time to the 3422 planets and exoplanets of today is vast.

Here's one way to evaluate the extent to which science depends on humans: Contemplate a civilization of technologically advanced extraterrestrials. What science would they produce given that they, like us, inhabit the same universe? Electromagnetism, organic chemistry, and quantum behavior are all features of the universe. If they aren't discovered and put to use, can a civilization even become technologically advanced?

My question isn't wholly rhetorical. If you can see other, nonterrestrial ways toward technological advancement, please put them in a letter and send it to PHYSICS TODAY. The email address is ptletters@aip.org; use your surname as the subject line.



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