Tips to Improve Your Science

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Abstract

Much modern science remains stuck inside antique thinking ruts. Weak data frustrates today's goal of more and better theory, sooner rather than later. This essay lists and links several strategies that will help your conceptual endeavors.

The world of science more than a century ago was different from today in many ways. However, in key areas there has been little improvement from weak ideas even during Einstein's times. As great as even he was, and how well he built on 19th century thinkers, there were blinders on his scientific vision. If he were alive today, Einstein would be a very different scientist.

I consider Einstein to be one of history's great thinkers, so this observation of 1915 Einstein is not a personal criticism. Indeed, some of the things that held back this great man still bewilder modern thinkers of equal intellect who remain bewitched by the correlative elegance of his mathematics.

Here below are some ways to perceive mental challenges with "beginner eyes." This open perspective is Buddhist, and also is the core of Plato's idea that the beginning of philosophy is awe.

There are several classical anecdotes regarding the wisdom of innocence. One of the oldest stories involves six blind Sufis

encountering an elephant together for the first time. Each one touched a different part of the beast, and thus got a distorted idea of its whole. One touched its leg and thought elephants are like trees; another touched its tail and thought elephants are like ropes; another touched its side and said elephants are like a wall; and so forth. All were right, and all were essentially wrong about what it means to be an elephant.

The lesson to learn here is that seemingly good data can lead to wrong conclusions, because the data set is not a random sample of the dimensional whole. Modern science is afflicted with its own Sufi dilemma – and tries to avoid it with cute math tricks such as renormalization and fuzzy conclusions from defective hypotheses. Today's science is like one or two of these Sufis.

Science before the current high-tech era did very well with mere laboratory experiments using simple tools, often in very small and basic labs. People such as Galileo with his simple telescope, and Faraday with his basic electromagnetic laboratory illustrate how much progress was once made with minimal tools. Considering everything, the 19th and early 20th centuries were a golden age for simple experimental physics.

The lesson to be learned from reliance on past experimental "proofs" is that we can slip into theories and methodologies that are not supported by what we are really researching. Evidence is filtered by what is already assumed to be causally correct, and then correlated into theory with the necessary equations.

One of the greatest weaknesses modern science faces is its technical inability to look at both smallest and largest linear dimensions, and the full range of electromagnetic frequencies. The problem here is that probabilities are only as good as our knowledge of the possibilities of the whole. If we cannot know the whole, then even good limited data is subject to rejection by the unknown unknown. It is our limited technical abilities, not our mental abilities that cause such fundamental error. After all, our brains have an estimated 100 trillion synapses.

There is a technique for honestly dealing with experimental hypotheses that seemingly work in the everyday world. A German philosopher, Hans Vaihinger, wrote about the "as-if." Within this viewpoint, scientists can operate as-if they know what creatures in our dimension cannot know, and still have skepticism about hypotheses from dimensionally limited data.

Even though high causal probability statements are not in order from within unknown, yet possible dimensions, we can compensate with repeated experiments on different instruments that operate within dimensions we humans can apparently measure. In a pure sense we can neither induct nor deduct from our data, but we can proceed as if we can. We can also employ the idea of scientific elegance, or parsimony, for our data. If our data comes from different directions, and it all points toward one elegant model, then we may proceed for now as-if a working hypothesis is at hand.

Most importantly, we must not fall in love with any paradigm or model, or slip into any gerbil path where the blind lead the blind. For example, the standard model of particle physics is very central to experimental science. However, a version outside what we think we can know is likely the correct model. Just spending more billions on ever larger colliders won't make a significant dent in the dimensional gap. But which theory version is best, and how much of it is causally congruent with the model du jour?

Theorists can retreat to their maths to conjure an apparently elegant view of everything. The premier idea of "maths = reality" is the idealism of Plato, and similar thinkers such as Euclid with his impossible plane geometry (not OK 3D geometry). A modern version of this absurd math modeling tool relies on finding equations that seem to fit many-dimensional worlds.

The summit of this madness is the stringy M-Theory idea that there are at least 10^500 actual universes, many similar to ours, but all unique with their own physics. Considering that there are

about 10^70 hydrogen atoms in our visible universe – going an additional 430 progressively larger linear dimensions, for entire universes no less, is cosmically absurd. At the very least an honest as-if viewpoint is required for us scientists. In the search for Truth hubris is of little value for the progress of science.

The conventional dominant thesis is energized by fear of not getting tenure among those still climbing increasingly crowded academic stairs. Fortunately for the real scholars in this world, many not-yet tenured academics pad their publish-or-perish credentials with excellent Wikipedia articles and linking references built around their narrow expertise.

The intellectual gerbil trail is reinforced by restrictive rules regarding peer-reviewed articles. Academic affiliation is required before even serious new ideas from the unwashed are reviewed. Thus a fundamental echo chamber is maintained.

Some centuries ago Galileo in Rome was "peer reviewed" by senior academics of his day. He escaped being burned at the stake only because he was a friend of the pope. Just ten years before Galileo in 1610 discovered the four bright moons of Jupiter, and then saw the phases of Venus, an enlightened Dominican friar, Giordano Bruno, was burned at the stake in Rome by the same senior "peer reviewers" for hypothesizing that celestial stars are distant and like our own sun, and that some of them have planets with life forms too.

As we can now see from the 21st century, Jesus had nothing to do with such "peer review" carnage. Power, greed, and fear of emerging ideas did. Evil likes to wrap a divine cloak around itself.

Going forward from today, we may never be able to develop experimental tools to see below the 10^-35m Planck dimension, even though that's where the particulate matter/energy for all that exists begins. Nor will we build any telescope that can see clearly beyond the boundaries of our local 4D visible universe.

Therefore, science must develop better analytical tools for exploration, even if such tools are only incrementally better than what we now have. We do this work within intellectual honesty to develop superior as-if hypotheses for the emerging 21st century.

This author has written several dozen essays to that effect, with more forthcoming, like chicks pecking their way out of their shells. If you are curious to learn more about where this century is heading, freely visit the domain, astronomy-links.net, and its "Clark's Web Pages" collection of diverse essays.