

SCIENCE AS DEMOCRATIZER

Robert Lawrence Kuhn

Does the pursuit of pure science make sense in a world of scarcity and strife? With so much poverty on the planet, why spend vast sums of money on, say, the James Webb Space Telescope, due to replace the Hubble at the end of the decade and observe the first stars and galaxies in the universe; or the Terrestrial Planet Finder, whose mission is to detect other habitable worlds—discoveries that, however astounding, can bring no tangible benefits here on this barely habitable world called Earth.

I'd prefer to argue that pure science needs no extrinsic justification—that to seek knowledge for its own sake is among the grandest of species-affirming human endeavors. Unfortunately, beyond a rarefied community of professionals and enthusiasts, such a view can seem self-indulgent and elitist, possibly irresponsible, and can even generate ill will among those who, by choice or necessity, have other priorities.

The usual rationale for spending public monies on scientific projects large and small is that they have the potential to make our lives longer, healthier, safer, happier, more productive, more pleasant. That science, even "pure" science, can strengthen democracy and promote public participation in the political process, both in the United States and throughout the world, is hardly ever mentioned. It should be. Scientific literacy energizes democracy, I suggest, and this is an important ancillary benefit of the promotion of science. Can this proposition be defended? I'd like to try.

I'll start with an observation. In general, countries that have stronger sciences have stronger democracies. And in countries where science has little strength and scientific ways of thinking have no apparent impact, governments tend to range from undemocratic to totalitarian. This is quite obviously correlation, not cause—and even if cause, the direction of the causation arrow is

unclear. A democratic country might foster science, perhaps as a second-order effect of the prosperity and high literacy conventionally coincident with democracy, just as logically as a scientific country might foster democracy.

A lack of even rudimentary scientific understanding cuts great swaths across the planet's population, and thereby threatens the global community by exacerbating inequalities and fomenting resentment. The rewards of science are distributed unevenly, straining social relations within the United States and widening the gulf between developed and developing nations. Knowledge is power, and whenever segments of a society, or entire countries, are separated from it, disenfranchisement and disaffection are often the result.

Just as advanced science and technology have begun to flourish in almost every corner of the world, anti-science currents are flowing faster, too—fed by a curious confluence of individual alienation, religious fundamentalism, extreme environmentalism and even elements of postmodern scholarship, with its tendency to view scientific research as affected by cultural bias. One sees close ties between the absence of scientific appreciation and the presence of demagogic intolerance—but even so, this is still correlation, not cause.

Deduction and Democracy

How might science engender democracy? I'd like to suggest two mechanisms: first, by changing the way people think; second, by altering the interaction among those who comprise the community. The more scientifically literate people become, the more they will expect, even demand to participate in the political process, and the more effective they will be at it. Such social evolution may be slow, nonlinear and chaotic, and periodically may even reverse course, but it is probably also inexorable, as the recent history of the former Soviet Union and other Communist countries in Europe shows.

A key to changing how people think is "critical thinking," the ability to draw logical conclusions, or (more often, in the messy world of social issues) the reverse—to discern gaps in logic, to detect broken conceptual links in the causative chain of, say,

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Figure 1. Former Chinese president Jiang Zemin spoke often at science conferences, promoting “revitalizing China through science and education,” a slogan still in use (bottom). (Photograph courtesy of *Beijing Daily*.)

campaign promises. Science amplifies our power of discernment; the scientific way of thinking enables us to assess whether facts fit theories, or, in the political arena, whether actual circumstances support proffered positions. Critical thinking is the essence of the scientific method. Knowing the difference between assumption and deduction, and between presumption and proof, can alter one’s outlook and transform an electorate. The cognitive skill to distinguish among hope, faith, possibility, probability and certitude are potent weapons in anyone’s political survival kit and can be applied in all areas of life and society.

A key to altering the interaction among those who comprise the community is to see science as a potential unifier. I am moderator of a television (Public Broadcasting Service) series called *Closer to Truth: Science, Meaning and the Future*, on which scientists debate fundamental issues. Those of us involved with the series have been surprised by the diversity of our viewership. E-mail audience feedback cuts across educational levels, gender, age, race, class and creed—the only common denominator being a keen interest in topics such as consciousness, cosmology and scientific creativity. This evidence suggests a vision of a diverse society where many value a scientific way of thinking. Such a society has the capacity to respect pluralistic political positions—the essence of democracy—since members can understand that no position, not even their own, can be “proved” to be the correct one with anywhere near absolute certainty. In fact, given the gaps, even chasms, in contemporary political views

(within countries as well as between them) the common language of science seems the only force able to provide common ground.

Consider China, conflicted by the tension between promoting science and restraining Western-style democracy. Even given the nation’s remarkable development since the advent of reform 25 years ago, education is still limited, and therefore, Chinese leaders believe, so must be competitive elections. China’s governing elite, virtually all science-trained engineers at the very top, do not want uneducated, scientifically naive peasants determining national policies, including the allocation of resources. (Would illiterate farmers vote for the information superhighway? asked one senior advisor, rhetorically.) Measures that would be unquestionably beneficial to China in the long run might not be especially popular in the short run. It is commonly held in China that democracy, a stated goal, can develop only to the extent that education, primarily scientific education, increases. “Revitalizing China through science and education” is a favorite slogan of former President Jiang Zemin, who was equally adamant in promoting science and opposing Western-style democracy, and his policy is being pursued by his successors. It will be fascinating to see whether and how democracy grows with scientific literacy.

In Muslim countries, which for centuries led the world in science, there is an incipient movement to encourage science as consistent with Islam. One devout scientist, a leader in the “Islam and science” movement, believes that teaching science in the religious schools (madrassas) is essential for instituting change.

Admittedly, so far I have only anecdotal observation in support of my thesis that scientific literacy is a natural precursor to political democracy. But it is testable. I envision a simple scatter diagram in which a country’s level of scientific literacy (on the x axis) is plotted against its degree of political democracy.

My guess is that the clustering of the data for the 192-odd countries of the world would be bimodal, with one grouping coherent and the other dispersed. Bunched in the upper right would be the known group of countries combining high science literacy and robust democracy. I expect that the other, dispersed grouping would be spread widely over the entire left and middle regions of the graph, since a larger number of countries have varying degrees of low- to mid-level science and low- to mid-level democracy, with weak correlations between them.

A better test of the thesis, though still unlikely to resolve the correlation-causation conundrum, would probably be longitudinal, tracking the changes of each data point over time as countries migrate in their science and in their governance.

In following countries over decades, as they would make the (often protracted) journey from lower left to upper right on the graph, from low

science—low democracy to high science—high democracy, we would ask: What are the paths of progress? I'd predict that there would be many routes. Some would appear linear, with proportional growth in science and democracy; others geometrical or sigmoidal, as affected by the forces of history: social turmoil, cultural subtleties and external forces.

Choosing a Path

There are counterexamples to the science-democracy conjecture. It fails to explain the accomplishments of Nazi and Soviet science, which flourished in societies that were among the least democratic. Scientific discovery can be driven by individual psychology, such as creativity under coercion and self-protective egos, and collective sociology, such as mass hysteria and national chauvinism. I would offer that the sprouting of a democracy-championing character such as Andrei Sakharov, the highly decorated father of Soviet thermonuclear weapons, is likely in a science-rich totalitarian society and virtually inevitable in an age when access to the Internet is essential for doing good science.

This is the dilemma faced by the leaders of China, who are motivated mightily by pride in China's development. They have before them two roads for national advancement: open Internet access and accelerate indigenous science, while allowing potentially destabilizing elements to enter society; or restrict access to maximize stability (needed, they believe, for uninterrupted development), thereby handicapping Chinese science in an unforgiving, hypercompetitive, global market that is energized by new knowledge and exquisitely sensitive to time.

Some might argue that imposing "science" as the highest standard of human thinking undervalues other areas of thought and artificially "privileges" one form of "knowing" over others. Science can in fact be differentiated from other forms of discernment since its primary power to influence sociopolitical development is more content-neutral, a "way of thinking" rather than a collection of fields and facts. Admitting where intuition outruns analysis—not easily done—should be the hallmark of rational assessment of political trade-offs, historical controversies, moral codes, the reality of religion, the meaning of art and the like.

The key point is that a proper understanding of the scientific way of thinking compels one to recognize where alleged proofs break down or are downright impossible to construct. This does not *a priori* obviate awareness or appreciation of a different kind of knowledge or "truth," but comprehending the distinction between proof and opinion should tend to make people more tolerant of the differing opinions of others. Certainly, humanistic understanding is complementary to the scientific for effecting political change, but primarily because it too engenders respect for the pluralism engendered by critical thinking. When citizens can

distinguish among proof, likelihood, opinion and hope—and get into the habit of so doing—democracy cannot long be kept from them. Of course, a democracy in full flower cherishes and protects political, intellectual and religious freedoms, artistic expression and literary inquiry.

The Spirit of Science

A fully democratic political system gives all its citizens the right to choose their leaders and representatives; the reciprocal responsibility, implicit in the social contract, is that citizens exercise their franchise with dedication and discernment. Democracy works successfully only when participants are informed and able to make independent judgments. The degree to which they can be swayed by demagogues, influenced by parochial interests, incited by jingoism, or inflamed by ethnic or religious chauvinism is the degree to which democracy does not work.

Challenging current beliefs in various fields of science with a noncynical skepticism creates a healthy mindset for a democratic and tolerant society. On *Closer to Truth*, we attempt to empower the public to participate in compelling debates about current research on the frontiers of science and its philosophical and social implications. When opposing positions are presented on, say, the nature of consciousness, we encourage all sides—and there are more than two sides to this and other fractious issues—to present supporting data or to admit where they are blurring the boundaries between personal opinion and accepted proof.

The scientific spirit is common to all peoples; it crosses cultures and bonds diverse elements of society, communicating an appreciation of the beauty as well as the benefits of new discoveries, the breathtaking complexity of our vast universe. Science opens the mind. Such are the intangible benefits of the Webb and Hubble telescopes and their like.

About those costly telescopes: I believe basic and applied science and science education are all needed to nourish critical thinking. Science, to be science, cannot stagnate. If scientific education enforces the scientific way of thinking, scientific discovery energizes it, so that both education and discovery nourish and sustain our democracy. And science needs democracy as much as democracy needs science. Vigorous scientific research reflects democratic principles in action, and free and open scientific inquiry cannot take place without the protective support of a robust democracy.

This is not a time to be timorous. With the state of the world as it is, critical decisions must often be made on incomplete data, and it seems to me that the science-democracy link is strong enough to merit action. Taken seriously, support of scientific literacy and research in the developing world could become America's most efficient use of foreign aid. By increasing the scientific spirit in the world, we would be catalyzing a converging way of thinking.