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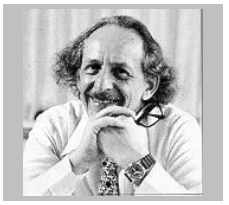

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Parascience, Pseudoscience, and Political Power: Gerald Holton on the Anti-Science Phenomenon—And Why It Should Not Be Dismissed as a Harmless Fringe

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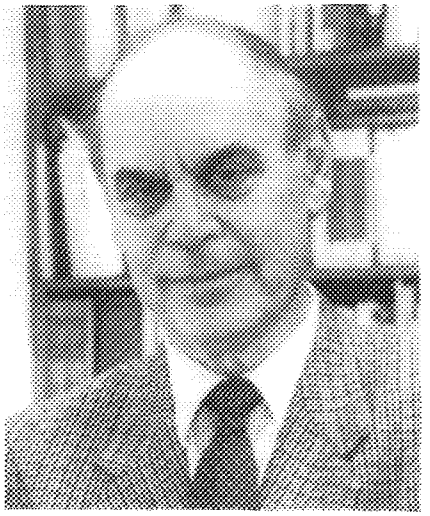
Introduction: Homage to a Mentor

I've often written of the many historians of science who have been mentors in my career.[1-3] We sometimes take mentors for granted, neglecting to tell the world how they played a role in our personal or professional lives. It came as a surprise to realize I hadn't yet acknowledged Gerald Holton as an important mentor or expressed my appreciation of his influence. An embarrassing surprise, really, since he wrote the foreword to a volume of *Essays of an Information Scientist*.[4] The *Current Contents*® (*CC*®) essay which follows is an opportunity to make up for this oversight.

Many *CC* readers will know from previous essays that Holton is Mallinckrodt Professor of Physics and professor of history of science at Harvard University, Cambridge, Massachusetts. He has distinguished himself both in science and the "science of science"—that is, his seminal contributions on the social and cultural aspects of science. It is here that our interests intersect and where I first "met" him.

Intersecting Interests: Jefferson and Einstein

For example, whenever I hear "Thomas Jefferson" I recall his 1981 Jefferson Lecture in Washington, DC. Selection to this award by the National Endowment for the Humanities is "the highest honor the federal government confers for distinguished intellectual achievement in the humani-



Gerald Holton

ties."[5] The lecture was cited in a previous *CC* essay on the bicentennial of the US Constitution.[6] I've also cited Holton's work on metaphors in science.[7,8] His book, *Thematic Origins of Scientific Thought: Kepler to Einstein*,[9] was featured as a *Citation Classic*® in *CC*.[10] These are in addition to our continuing discussion and correspondence on art and science.

Thomas Jefferson said science is fundamental to the health of the US.[5] It is refreshing to recall how much of its current research leadership the US owes to the influx of brilliant European scientists, like Albert Einstein, around the time of World War II. Like so many others, I have an abiding interest in the life and work of

Einstein, a subject which Holton has researched so well.[11]

Refugees from intolerant, intolerable, totalitarian states, these emigrant researchers reinforced the intellectual infrastructure of generations of scientific progress in the US, where both the "freedom and happiness of man" and the advancement of knowledge were the two goals of science, to quote Jefferson again.[5] Holton, too, emigrated to the US to escape Nazi persecution in Germany, where he was born in Berlin of Austrian parents. And our social sciences scholarship has been enriched as a result.

Parascience and Pseudoscience: Not a Harmless Fringe

Holton sent me a presentation he made to a conference on "Anti-Science and Anti-Technology Movement in the US and USSR," which was recently published in a new journal, *Public Understanding of Science*.[12] It was a penetrating analysis of the gamut of "fringe science"—from astrology to Lysenkoism to creationism. It also explained why it is unwise to dismiss this "anti-science" phenomenon as a harmless fringe at a time when it is building political momentum and influence. Finally, Holton constructed a theoretical framework and practical strategy for dealing with the phenomenon.

The relevance and interest of the paper to *CC* readers seemed obvious. However, space would not permit a reprint of the *complete* 26-page original. So it was decided we would condense the paper. The resulting digest follows. Although the digest is only about one-third the length of the original manuscript, it preserves the thrust of Holton's thoughts on anti-science.

However, the digest by no means substitutes for Holton's original article on the anti-science phenomenon. It is meant to draw attention to an important issue for the research community by presenting his elegant and incisive analysis of it. We hope it will encourage you to read the *entire* text in *Public Understanding of Science* to fully appreciate Holton's insights.

About the Author

Holton received a bachelor's and master's degree in physics from Wesleyan University. He also earned a master's and PhD degree, both in physics, from Harvard. Concurrent with his Harvard appointments, Holton is a visiting professor at the Massachusetts Institute of Technology (MIT), where he was a founding faculty member of the Program on Science, Technology, and Society. A member of numerous prestigious professional organizations worldwide, he has also received many honors and awards—including the Millikan, Oersted, and Sarton medals.

Over the past decades, Holton has pursued three related research interests. One has been the relation between science and culture, which has involved the founding of *Daedalus* and the publication of numerous books and essays. Another interest has been the intersection between science, technology, and society. This has encompassed the founding of *Science, Technology and Human Values*, the MIT educational program, and other major activities. His third major interest is the dynamics of growth in science, including sociological models for the expansion of research. His publications on this topic are too numerous to mention here.

A New Journal on the *Public Understanding of Science*

As noted earlier, the article digested in the following was published in the inaugural issue of *Public Understanding of Science*, on whose editorial advisory board Holton serves. Launched by IOP (Institute of Physics) Publishing and the Science Museum, London, its goal is to provide an international forum for studies on the public dimensions of science, technology, and medicine by educators, historians, sociolo-

gists, policymakers, media analysts, and others. In particular, it has positioned itself as the one journal "wholly or mainly devoted to" public understanding of science, as explained by the editor, John Durant, the museum's assistant director and head of science communication as well as visiting professor at Imperial College of Science, Technology and Medicine, London.[13]

I was pleased to learn that a number of colleagues and friends are among the associate editors and editorial advisory board. These include Subbiah Arunachalam, Central Electrochemical Research Institute, Karaikudi, India, who also serves on the editorial board of *Current Science*; Sir Walter Bodmer, Imperial Cancer Research Fund, London; David Edge, University of Edinburgh, Scotland; Bruno Latour, Ecole Nationale Supérieure des Mines, Paris; Bruce Lewenstein, Cornell University, Ithaca, New York; Dorothy Nelkin, New York University; Arie Rip, University of Twente, Enschede, The Netherlands; and John Ziman, Science Policy Support Group, London.

Interested readers can order a free sample issue of the new quarterly journal by contacting IOP Publishing, Techno House, Redcliffe Way, Bristol BS1 6NX, UK. European orders can be placed by phone (0272-297481) or fax (0272-294318). The numbers for North America are 516-349-7800, ext. 628, and 516-349-7669, respectively.

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How to Think About the 'Anti-Science' Phenomenon*

By
Gerald Holton

Opposition to science as conventionally defined can take a great variety of forms, from interest in astrology to attacks on relativity theory, from false beliefs based on scientific illiteracy to support of Lysenkoism or Creationism. Which of these are relatively negligible, and which are potentially dangerous? What do these symptoms of disaffection portend, for science and culture in our time?

Belief in anti-science (or 'alternative science', 'parascience') is grounded in a person's functional worldview, and is one symptom of a long-standing struggle over the legitimacy of the authority of conventional science. This analysis leads to the identification of a set of strategies for dealing with the counter-visions which periodically attempt to raise themselves from the level of apparent harmlessness to that of politically ambitious success.

The surface of the problem

My main task is to outline how to think about anti-science at the proper level. The term anti-science can lump together too many, quite different things that have in common only that they tend to annoy or threaten those who regard themselves as more enlightened. We must disaggregate from the disparate jumble that which is the truly worrisome part of anti-science, so that we can discriminate between 'real' science (good, bad, and indifferent; old, new, or just emerging; etc.); pathological science (as in Irving Langmuir's essay on people who thought they were doing real science but were misled[1]); pseudo-science (astrology and the 'science' of the paranormal); blatant silliness and superstition ('pyramid power'); scientism (the exaggerated claims of technocrats for scientific and technological powers, as in 'Star Wars' projects); and other forms.

Thereby we shall be able to focus on the single most malignant part of the phenomenon: the type of pseudo-scientific nonsense that manages to pass itself off as an 'alternative science', and does so in the service of political ambition. Here our Soviet colleagues will be able to instruct us because of their unhappy experience in past decades with Lysenkoism, attacks on the relativity theory and quantum mechanics, and on cosmologists who were thought to have offended against the doctrines of Engels's *Anti-Dühring*.

Much of what looks at first glance like anti-science turns out to be something else. For example, much of tabloid sensationalism involving UFOs is merely hucksterism feeding on primitive ignorance (unless, as with the reputed inauguration of a section on 'UFO-logy' in the Soviet Academy of Science, the craze gets official backing).

Yet, if our aim is to filter out, name, and analyse the really dangerous segment of what some call the anti-science movement, we shall not find much help in the literature. There exists no adequate, serious treatment of it, nor even of the modern outlook that feels threatened by anti-science. All of us enter this study equally in need of a better understanding.

Why does the 'anti-science phenomenon' concern us?

In a democracy, no matter how poorly informed the citizens are, they do properly demand a place at the table where decisions are made which have a large scientific/technical component. In that mismatch of rights and knowledge base lies the potential for erroneous policy and eventual

* Greatly condensed from an article in *Public Understanding of Science* 1(1):103-28, January 1992. The complete version will be published in: Holton G. *On science and anti-science*. Cambridge, MA: Harvard University Press, 1993 (chapter 6). Based on a presentation to the Joint US-USSR conference on 'Anti-Science and Anti-Technology Movement in the US and USSR', held 2-3 May 1991 at Massachusetts Institute of Technology, US.

social instability. History has shown repeatedly that a disaffection with science can turn into a rage that links up with far more sinister movements.

Thoughts of this kind are really behind the concerns that the phenomenon of anti-science raises in the minds of many intellectuals, West and East. By themselves, all the astrologers, anti-evolutionists, spiritualists and peddlers of new-age thinking could otherwise be merely a source of condescension or amusement. We seem to discern behind these multi-faceted phenomena something perilous, a potentially fatal flaw in the self-conception of the people today. Could it be, at this end of the century, that the widespread lack of a proper understanding of science itself might be either a source, or a tell-tale sign, of a culture's decline?

One may try to shrug off such dark thoughts by pointing to the bright side, not least the practically universal popular enchantment with high-tech. One may seek comfort in the fact that even though only less than half of the US adult population believes in the evolutionary descent of human beings from earlier species, and even though half has trouble finding one side of a square when given one of the other sides, the US public at large reports to pollsters a greater level of belief in the potential of science and technology as a force for the good (at least in the abstract) than equivalent tests have shown for other major industrial countries, such as France and Japan.

This uninformed assertion of interest is not troubled by the well-documented, contradictory feeling about scientists, which is less positive. In America at the end of the twentieth century it is not science but religion which, as in the days of the seventeenth-century Pilgrims, is perhaps the strongest force in private and national life—just as Tocqueville had noticed in the 1830s. About one-third of our adults, and a large fraction of these from evangelical sects, now say they are 'born-again' believers; over half believe in the possibility of the daily occurrence of miracles through prayer; 60% say they believe in the literal existence of Hell for the eternally damned. And the financial support given last year as private donations to religious organizations amounted to a remarkable $54 billion. Still, the large majority of average Americans report experiencing no conflict at all between science and faith, despite the fact that the modern science-based worldview evolved in good part from the reaction to contradictions between these two undeniable imperatives.[2]

Anti-science as counter-vision

The anti-science phenomenon is not at all just an incomplete or ignorant or damaged form of the 'proper' worldview that many of us here believe should characterize our civilization at this time in history. Instead—and leaving aside the banal, relatively harmless or ignorant varieties—what the more sophisticated so-called anti-scientists offer is, to put it bluntly, an articulated and functional, and potentially powerful counter-vision of the world, within which there exists an allegiance to a 'science' very different from conventional science.

Today there exist a number of different groups which from their various perspectives oppose what they conceive of as the hegemony of science-as-done-today in our culture. These groups do not form a coherent movement, and indeed have little interest in one another. But what they do have in common is that each, in its own way, advocates nothing less than the end of science as we know it.

Let me just name the four most prominent portions of this current counterconstituency. Starting from the intellectually most serious end, there is a type of modern philosopher who asserts that science can now claim no more than the status of a useful myth—the term is used by Mary Hesse—not to speak of a new wing of sociologists of science who, going far beyond their reasonable task, wish, in Bruno Latour's words, to 'abolish the distinction between science and fiction'.

Next, there is a group, small but very influential, of alienated intellectuals, of whom Arthur Koestler served as prominent exemplar. For them to be doomed to igno-

rance is the worst wound. But the fantastic growth rate of new knowledge, and our spotty record as educators, has inflicted on them, as Lionel Trilling honourably confessed, a devastating 'humiliation'.[3]

Third, there is a resurgence among what I have called the Dionysians, with their dedication ranging from 'New Age' thinking to wishful parallelism with Eastern mysticism, from intellectual anarchy to crystal power.[4] Some have their roots in nineteenth-century Romanticism, some in the 1960s' counter-cultures; but all agree that one of the worst sins of modern thought is the concept of objectively reachable data.

A fourth group, again very different, is a radical wing of the movement represented by such writers as Sandra Harding, who recently said physics today 'is a poor model [even] for physics itself'. For her and her like-minded colleagues, science now has the fatal flaw of 'androcentrism'; that, together with faith in the progressiveness of scientific rationality, has brought us to the point where, she writes, 'a more radical intellectual, moral, social, and political revolution [is called for] than the founders of modern Western cultures could have imagined'.[5]

That these groups have been able to gain considerable attention is due in part to the fact that the ground for dismay with modern science and technology has been prepared by three different factors, all operating in the same direction.

First, with science and engineering now central components of modern life, from birth to death, it is not surprising that concern is widespread over some real or imagined consequences of science-driven technology, nor that some of these concerns have in fact been first examined and made public by scientists and engineers.

This leads to the second factor, of which the now international ecology movement is an indicator. Earlier than even most scientists, some critics intuited the fragility and delicacy of the interconnections that govern the well-being of all species on Earth. Their methodology and their rhetoric may not always have been sound, but their motivation has been a Darwinian one.

The need for ecological-systems thinking, both for its benign significance and because of the evident threats, is rather new, having emerged into global thought only in the last third of the twentieth century, and is bound to become a chief preoccupation of the twenty-first. There were of course very significant pioneers earlier, such as John Muir and Patrick Geddes, who prepared our minds in terms of their local or localizable concerns. Even Rachel Carson was focusing only on the threats to the ecosystem from certain chemicals. We now treasure these pioneers even more, because they prepared us to understand better the global meaning that had to be extrapolated from their messages.

Last but not least, with the rise of many scientists to visibility and prominence in our own nation's life, something was triggered in the American response which is perhaps idiosyncratic for this country but in fact is fundamentally healthy—namely, scepticism against this, as against any, form of strong, organized authority.

Three types of ameliorating strategies, and their limits

I began by asking the question whether the multifaceted anti-science phenomenon, even if widespread, is at bottom only a more or less harmless diversion, or whether it signals an important cultural challenge and therefore must be taken seriously.

My answer is now clear. If we leave aside as intrinsically unimportant the passing fads, ignorance, banalizations, etc. (and their commercial exploitation), we can focus on pseudo- or parascientific schemes that arise from deep conviction. These are grounded in a fairly stable and functional, motivating worldview. It is these that can be directed at the core of contemporary culture (as would, for example, an analogous anti-literature phenomenon: in fact, some of the new cultural movements in the USA have just that purpose). Even though the counter-constructs embodying parascience are a minority view today in the USA, their entrenchment is a living reminder of an old, worldwide struggle of mutual delegitimation of rival cultural claimants.

How alarming this is felt to be depends of course on whether earnest and successful interventions are undertaken in opposition to the counter-construct, or whether intellectuals and policy makers on the whole will lazily continue to give only lip service to this problem, as they have done with scientific and general cultural illiteracy.

As a practical matter, there seem to be only three types of interventions that make sense:

1. The traditional one: formation, from an early age on, of a modern worldview that will preempt the attractions of its opposite. This implies not only early nurturing of the child by a sound educational system designed for this purpose; one would also need the support by that individual's parents, teachers, and other caregivers who themselves should have passed through an education of this kind.

2. Interactions of the sort that bring to light directly the internal contradictions in the alternative picture; or massive and persistent adult education efforts.

3. Widely visible exposure of the failures of the claims of parascience, and persistent political action to prevent its formal acceptance into schooling systems. Thus, while convinced followers of 'creationism' themselves are probably unreachable owing to the robustness and internal functionality of their supporting world picture, at least one can reverse, as was done recently in Texas after a decade-long fight, the stranglehold of these powerfully presented minority views on the selectors of textbooks for the whole state's school system.

Toward a conclusion

Among examples that help us derive guidelines are two in particular. One is the rise of the machine-breaking Luddites in Britain in 1811 to 1816. It was a movement first spawned by economic grievances, but eventually became a violent explosion against the technological symbols of a suffocating and unyielding factory system.[6]

Here I wish only to refer to it, as it has a certain overlap with the other example, which took place in the 1920s and early 1930s. In the early phase of the growth of Nazism in Germany, there arose, in the words of Fritz Stern, the 'cultural Luddites, who in their resentment of modernity sought to smash the whole machinery of culture.'[7]

In looking back on such historic cases, we can draw two important lessons. The first is that alternative sciences or parasciences by themselves may be harmless enough (except as one of the opiates of the masses), but that when they are incorporated into political movements they can become a time bomb waiting to explode.

We have recently been watching just such a possibility in the USA. Among the relevant documentation is an essay by James Moore, released by the American Academy of Arts and Sciences, entitled 'The Creationist Cosmos of Protestant Fundamentalism'.[8] It chronicles the recent rise and political power of the anti-evolution movement in the USA. While opposition to evolutionist teachings has a long history in America, Moore notes that 'today, Fundamentalists may have a fair claim that up to a quarter of the population of the US, and a rapidly increasing number of converts worldwide, live in a universe created miraculously [in six days] only a few thousand years ago, and on an earth tenanted only by those fixed organic kinds that survived a global Flood.... The creationist cosmos of Protestant Fundamentalism has acquired an authority rivalling that of the established sciences' (p. 46).[8]

The most noteworthy point is the joining of 'Creationism' with the agenda of politically ambitious evangelists such as Falwell, Robertson, Swaggert, Bakker, and Kennedy. As the proponents' published view shows, the stakes are much higher for them than merely displacing current biology texts. They focus on the traditional Fundamentalist task: how to prepare this world for the coming of the next.

On the way to that goal, they have encountered surprisingly little vocal opposition from the world of scholarship, science, or theology in the USA. On the contrary, they have acquired powerful allies in high places. Their sympathizers included a President of the USA in the 1980s; he is on record as holding to a worldview that has

open arms not only for astrology, but also for UFOs, for Creationism, and for a form of Fundamentalism that concerns itself with the inevitable approach in the near future of an apocalyptic Ending.

The other lesson to draw from our historic cases is simply this. History records an important and revealing asymmetry: the original Machine Luddites of the nineteenth century were soon brutally crushed; but the Cultural Luddites have often, at least for a time, been the winners, although at great cost to their civilization.

It is sobering that in every case there were intellectuals who tried to stand up to the Cultural Luddites, but they rose too late, were far too small in number, received little encouragement from their peers, and had less commitment and staying power than did their opponents.

As we have seen, history records that the serious and dedicated portion of the anti-science phenomenon, when married to political power, does signal a major cultural challenge. In short, it is prudent to regard the committed and politically ambitious parts of the anti-science phenomenon as a reminder of the Beast that slumbers below. When it awakens, as it has again and again over the past centuries, and as it undoubtedly will again some day, it will make its true power known. Those who care to learn the lessons of the past may be well advised to try to defang the counter-vision even in its present, less virulent state.

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