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Current Comments

Is Public Confidence in Science Declining?

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Current Contents® (*CC*®) readers know of my special interest in science journalism.[1] Over the past few years, we've published numerous essays discussing popular science magazines.[2] The success of these magazines undoubtedly reflects a heightened interest in science. One might also conclude that it demonstrates a growing public support for the scientific community. Yet, in 1970, the US government began to eliminate the National Science Foundation's precollege science education programs and, by 1981, had phased them out altogether.[3] Public opposition to such technologies as nuclear power is on the rise.[4] And many television shows—ranging from Saturday morning cartoons to serious dramas—portray scientists as antisocial, elitist, and often evil geniuses with no regard for the effects of their work. Factors such as these have convinced many scientists that public support for their profession is on the decline.

Fear, or distrust, of scientific and technological inquiry has been a problem for almost as long as human beings have sought knowledge. According to Robert K. Merton, Columbia University, hostility toward science has been present in many societies for centuries, flaring up and subsiding according to the social conditions of the time.[5] For example, in the sixteenth century, Copernicus was condemned by the Catholic church for placing the sun at the center of the universe. During the seventeenth century, however, the Protestants sought to reconcile science and religion. They taught that "science is a way of learning about God by studying his creation, the world of nature."[6] (p. 34) Perhaps the most notorious opponents of technological progress were the Luddites, English handicraftsmen who in the early-1800s destroyed textile machinery out of fear of losing their jobs.[7] They assumed their name in memory of a man named Ned Lud. In about 1779, Lud was reputed to have destroyed frames in a "stockinger," or hosiery-maker's house.[8]

While the current disenchantment with science has not reached such proportions, science does appear to be experiencing a period of increased public skepticism. Surveys performed during the past 15 years have shown a growing skepticism toward all social institutions, including science, in the US. On a more optimistic note, however, polls show that science's status relative to these other institutions actually rose during the period—from fourth to second place, ranking just below medicine.[9]

While the student unrest and opposition to the Vietnam War that characterized the late-1960s and early-1970s may have contributed to the public's lack of enthusiasm for all institutions, a number of specific causes for the current disenchantment with science are shown through these surveys. In a comparison

of polls measuring the public's attitude toward science first in 1957 and then in 1979, the National Science Board (NSB) reported that the number of people who believed the benefits of science outweighed the harmful results fell by 21 percent. Similarly, in 1979, 13 percent fewer people believed that scientific discoveries were making life easier, healthier, and more comfortable.[10]

While the majority of respondents in the NSB polls continued to believe that science was improving their lives, there was a significant drop in the number of people who share this view. Is this erosion of confidence in science serious enough to challenge the future of scientific research? Most pollsters think not. According to Alan Mazur, Syracuse University, most members of the public "recognize both good and bad features of science and technology, combining them into a net view that is *positive*, if qualified."[9] The question, then, remains: what are these qualifications and how seriously are they affecting the public's perception of science?

During the past two decades, a number of conferences have been held on this question. The impact of science and technology on society, and the public's perception of this impact, have become such pressing issues that, in 1972, a journal dedicated to this topic, now called *Science, Technology, & Human Values* (*STHV*), was founded. This journal is sponsored by the Program in Science, Technology and Society, Massachusetts Institute of Technology (MIT), and John F. Kennedy School of Government, Harvard University, and is just changing publishers, from MIT Press to John Wiley & Sons. Although the opinions voiced in *STHV* and at these conferences vary widely, a number of central themes emerge.

One of the primary reasons for the increased skepticism toward science appears to be the public's reexamination of the assumption that all scientific progress is positive. Perhaps as a result of the public's increased awareness of science, people are questioning the validity of developments that, ultimately, have such negative side effects as environmental pollution and overpopulation.[11] While it can be argued that these effects are caused by technology, or the application of scientific knowledge, pollsters have found the public by and large does not distinguish between science and technology.[12,13] Merton reports that, often, "the antipathy toward the technological products is projected toward science itself."[5] (p. 261)

According to R. Gordon Shepherd, University of Central Arkansas, "In the layperson's view...the primary function of science is popularly seen as its ability to stimulate technological solutions to complex problems of practical import."[12] Unfortunately, this view of science is also being used to support the critics' contention that "science has become subservient to these technologies and to some extent has fueled their application and diffusion." Harvey Brooks, Harvard University, notes that critics who take this stand believe "science can no longer claim its distinctiveness from technology or assert its neutrality with respect to the political controversies of our time."[13] (p. 99)

This change in the public's attitude toward scientific and technological progress represents a marked reversal of the optimism toward science that prevailed in the 1950s, according to D.K. Price, Harvard University.[11] In a collection of essays on the relationship between science and the public, Price points out that when politicians began voting large appropriations for scientific research after World War II, they assumed that knowledge of science would be translated into useful social ends. This assumption is now being challenged by legislators, the public, and even many

scientists. The military strength made possible through research is now perceived as "an invitation to war, not a safeguard" against it.[11] (p. 97) And industrial growth is viewed as a prelude to environmental disaster. The frequent protests against nuclear power and environmental hazards reflect the public's belief that "we had been blithely charging ahead without giving any serious thought to the long-range consequences of our technological decisions."[14]

Polls clearly support this view. Fifty-seven percent of the people questioned in a survey of nine West European nations felt "some scientific discoveries are put into practice before the future consequences have been sufficiently studied." An even larger percentage, almost two-thirds of the respondents, believed "scientific and technological development is sometimes accompanied by increasingly large risks that will be difficult to overcome."[10] These polls, and the growing conviction that the risks of science and technology outweigh the benefits, have led many pollsters to join Daniel Yankelovich, Public Agenda Foundation, a New York-based nonprofit research center, in concluding that we are currently witnessing an "erosion in the consensus view of unqualified belief in science and technology as an instrument of growth and progress."[15]

Brooks believes this disillusionment with scientific and technological progress is part of a wider "disenchantment with the side effects of modernization and the industrial revolution, and what is seen as the increasing alienation of man from nature and from his own fellows."[13] (p. 98) During a 1979 conference, convened in Berlin to discuss the growing distrust of science, participants concluded that the products of science and technology have become so large and impersonal that individuals are bound to feel dwarfed and threatened. In the summary of the proceedings of this conference, published under the title *Fear of Science—Trust in Science*,[16] Karl W. Deutsch, International Institute for Comparative Social Research, Science Center Berlin, and Harvard University, and Andrei S. Markovits, Wesleyan and Harvard Universities, suggest there may be a "scale effect" in this distrust of science. Scientific research that helps individuals increase their options, and gives them a sense of control over their lives—for example, health-related research—is welcomed. Scientific and technological advances, such as genetic research, that are perceived by the public as decreasing their control are feared and resisted.[17] From this perspective, distrust of science and technology is viewed as part of a more general distrust of institutions that limit individual freedom.

Survey questions focusing on the types of research people oppose seem to support this view. The majority of respondents in a ten-nation poll on expectations for the year 2000 were opposed to scientific research that affected human genetic makeup.[18] In the 1979 NSB poll, respondents opposed the creation of new life forms.[10] Johan Galtung, University of Oslo, Norway, suggests, "The skepticism here is probably related to a feeling that there should be an inner sphere around man, a sphere of privacy into which science should not penetrate, where perhaps chance should reign rather than external forces imposed from the outside."[19] (p. 62)

Despite the growing realization that the indiscriminate growth of science and technology can limit individual freedom and have harmful side effects, the public continues to support scientific research that contributes to its material well-being. The respondents to the 1979 NSB poll preferred to see their tax money spent on scientific and technological research concerned with health, education, and the development of energy

resources.[10] According to the NSB report, "The consistently low ranks that exploration of space and search for new knowledge about man and nature have held suggest that the public's interest tends to focus on the practical and immediate rather than on results that are remote from daily life."[10] (p. 167)

This emphasis on research that yields practical and immediate benefits may explain why support for "discovering new basic knowledge about man and nature" is declining faster than support for applied research.[4] Only eight percent of the people surveyed for the 1979 NSB poll preferred to spend their tax dollars on "pure science"—compared to 21 percent in 1974.[10] A number of scientists attribute this diminished support to the public's lack of knowledge about the role fundamental research plays in scientific activity.[4] However, Maurice Goldsmith,[20] Science Policy Foundation, London, and Marcel C. La Follette,[3] editor of *STHV*, believe it reflects the public's and politicians' feeling that basic research usually doesn't focus on human needs. Goldsmith and La Follette believe the public is demanding that scientific funding agencies reexamine their priorities for basic research, and support those projects that may provide answers to society's most pressing problems.

Skepticism about the reliability of scientific data also seems to be playing a role in the current erosion of support for science. This skepticism stems, in part, from the public's increased awareness of science, gained through popular press reports and the educational support science received in the late-1950s and early-1960s, when the US was racing the USSR to land a man on the moon. However, it also stems from the greater visibility of scientists, afforded through their entry into the political arena. Particularly in the past few years, scientists have been publicly voicing their concerns about new technologies and discoveries. Molecular biologists led the call for a moratorium on recombinant DNA research.[21] And physicists were among the first to adopt a "go slow" policy for the proliferation of nuclear weapons. As was pointed out in an essay on the Three Mile Island accident,[22] by providing complex, and conflicting, data to support their views, the scientists on both sides of such controversies often confuse the public. This raises the question, put forth in *STHV* by Leon E. Trachtman, Purdue University: "When there is no consensus, why inundate the public with ambiguous and contradictory reports, but offer them no way of assessing or evaluating the reports?"[23]

The answer, in my view, is that the public can grasp scientific information, and will benefit from a greater knowledge of scientific issues. In fact, Yankelovich has found that when people are given background information on scientific and technological issues, they are capable, and willing, to participate in policy decisions they feel will affect them.[15]

Confusion about the "objectivity" of scientific experts has been compounded by the government's use of science to legitimize legislation of a largely political or ethical nature. For example, scientists are being called upon to testify about "when life begins," a moral, rather than scientific, issue. In *Love Canal*, Adeline G. Levine, State University of New York, Buffalo, notes that residents of an upstate New York community in which chemicals from a dump were surfacing felt scientific facts and statistics about their exposure to toxic chemicals were being interpreted in ways that legitimized bureaucratic and political goals.[24]

The political use of scientific data is increasing with the government's growing reliance on risk analysis. As was explained in a recent two-part essay,[25,26] risk analysis is a discipline aimed at

determining whether the benefits of new technologies are worth the risks. In her review of the proceedings of a conference on the use of scientific data for health and safety regulation, Susan G. Hadden, University of Texas, notes: "Although the data are good enough to indicate that there is a risk, they are usually not good enough to establish the level of risk with certainty. This gives policy-makers a large measure of flexibility in using the scientific evidence as a basis for policy-making."[27] This "flexibility" was responsible for much of the confusion surrounding the US government's proposed ban on saccharin, an issue which focused public attention on the uncertainty of scientific data.

As it turns out, the majority of respondents in a 1975 NSB poll felt that government and business were responsible for most problems caused by science and technology. Therefore, they seemed somewhat capable of distinguishing between political and scientific issues.[28] Even so, it is essential that scientists who enter the political arena make it known when they are voicing their *opinions*, and make it clear that scientific data are open to interpretation. Scientists must also speak out when they believe scientific information is being manipulated for political purposes.

The unfulfilled promises of science, and scientists, may also be responsible for the public's growing awareness of the profession's fallibility. Paraphrasing the response of Joseph E. McGrath, University of Illinois, Urbana, to a survey of the research community taken for a report on the state of science, *Science at the Bicentennial*, the NSB report says: "The very operation of the research-support and research-publication enterprises has to some degree encouraged scientists to promise benefits that they could not realistically expect to deliver. A scientist is almost forced to make such claims if he is to get research support or even get recognition for his work." McGrath adds that there also seems to be "a kind of naivete among many scientists that leads them to believe that their science really can solve any problem, given enough time, money, and effort."[29] (p. 78)

Charles Tyroler II, Counselors on National Problems, suggests that the large sums of money poured into cancer research over the past decade may characterize this naivete. He writes, "In my view, the relatively meager results from the huge expenditures on cancer research may be laying the groundwork for public disenchantment with science, scientists, and scientific research."[30]

This increased awareness of the scientific community's limitations, and of the uncertainties inherent in scientific data, is a major factor in the public's skepticism toward science. However, other external forces also seem to be at work.

Disenchantment with science and technology has been exacerbated in recent years through higher literacy, education, and the diffusion of anti-science and anti-technology views through the mass media, according to Brooks.[13] Several years ago, I pointed out that the majority of television programs portrayed the scientist as foolish, unattractive, and evil.[31] More recently, in a study of television's influence on people's conceptions of reality, George Gerbner and colleagues, University of Pennsylvania, found that these images persist. They also found a "special affinity between science and violence in television."[32] According to Gerbner, this negative portrayal of scientists may be undermining the confidence of science's biggest supporters—young, middle-aged, and middle- and high-income people.

At least part of the blame for science's negative image also lies with the film industry. Recently, George Comstock and Heather Tully, both of Syracuse University, reviewed portrayals of innovation

in motion pictures. They defined innovation as "invention, experimentation, research, design, development—intended to alter the existing state of affairs." Based on a sample of 15,137 films, they concluded, "Overall, films offer the picture of the lone innovator motivated to use his or her creativity to do good, but in the end causing harmful consequences for self and others."[33]

The news media aren't doing much to improve the image of science either. In a recent survey of scientists and journalists, Stanley Rothman, Smith College, and S. Robert Lichter, George Washington University, pointed out that the media tend to pay disproportionate attention to "antiestablishment" scientists, and to exaggerate disagreements among scientists.[34] Add to this the fact that the small amount of science news that is presented too often focuses on crisis situations, such as nuclear reactor accidents and chemical spills. Even news of major medical breakthroughs is presented in a superficial manner. Clearly, more coverage of the truly significant, rather than crisis or controversial, science news is needed.[1] However, as Deutsch notes, "When 25 people hold a bonfire in front of a power station, this is news and looks very interesting on television. But if a professor of physics points out that an anticipated risk has proven to be exceptionally small, this is not news and doesn't get on television or in the papers."[35]

Unfortunately, when the media focus on controversy, they may be discouraging public support for whatever scientific discovery or technological development the controversy surrounds. Mazur has found, "When coverage of a controversy increases, public opposition to the technology in question (as measured by opinion polls) increases...." He attributes this opposition to the public's "inherently conservative bias," and concludes, "If doubt is raised about safety issues, many in the public prefer to err on the side of safety."[36]

Perhaps the public would take a more reasoned approach to controversial issues if journalists provided more in-depth coverage of these issues. As I've said before,[37] thousands of scientific experts are available to the media through the Scientists' Institute for Public Information's (SIPI) Media Resource Service. SIPI, a nonprofit organization, maintains a computerized list of about 10,000 scientists who are willing to speak to journalists about developing news stories.

For almost a decade now, I've been urging scientists to concern themselves with society's view of science and technology.[38] They can keep up with the literature on this issue by consulting such journals as *STHV*, *Public Opinion Quarterly*, *Journal of Communication*, *Minerva*, *Daedalus*, and *Social Studies of Science*, all of which are covered in *CC/Social & Behavioral Sciences*. In *ISI® Press Digest*, which follows the essays in *CC*, and in *Current Controversy*,[39] the monthly newsletter cosponsored by ISI and SIPI, we excerpt articles from these and other scholarly and popular journals. In this way, we try to alert scientists and journalists to the growing literature on this problem.

But awareness of public sentiment on controversial scientific issues isn't enough to counter what appears to be a period of growing disenchantment with science. If we are to defend the integrity of our profession, we must accept the fact that we are now in an "era of public participation in science,"[40] and make every effort to ensure that this participation is founded on sound, and complete, information.

Kenneth Prewitt, Social Science Research Council, points out that as scientific and technological issues become

more important to society, "the deeply held political values of democratic accountability and public scrutiny have naturally and inevitably impinged on science policy." The public—including what he terms the attentive public, that one-fifth of the people who are knowledgeable about and concerned with science—is demanding "observable benefits" from its investment in science.[41]

Scientists must not depend exclusively on such media personalities as Carl Sagan and Isaac Asimov to explain and defend science to the public. Nor should they condemn these scientists for their outspokenness. Instead, they must join them in taking the time to explain their research to the media, admitting to the uncertainties of their findings, and avoiding the temptation to overstate the potential applications of their work. They must also speak out when they believe they've been misrepresented by the press, or on television or film. Clearly the day of the scientist sequestered in his laboratory, professing the value of knowledge for its own sake, is gone.

Scientists must also alert legislators to the relationship between research and economic development. In a recent essay,[42] we noted that about one-third of the measurable US economic growth between 1948 and 1969 derived from advances in basic knowledge. Scientists must seek out information of this sort and present it to their representatives.

This last point leads me to reiterate a plea I've made on many occasions[43]—scientists must form a lobby to represent their interests before legislators. I was gratified to learn that last year scientists formed such an organization. Known as SCITEC-PAC, or the Science and Technology Political Action Committee, this organization's goal is to support candidates for federal public office who will "work to provide a healthy and productive environment for the teaching of, and continued research in, science and engineering." Given legislators' view that support for science "doesn't translate into financial contributions, campaign assistance, or votes," scientists would be well-advised to join SCITEC-PAC. They can be contacted at Post Office Box 351, Rockville, Maryland 20850 (telephone 301-424-0002).[44]

Through SCITEC-PAC scientists can help Congress take steps to counter the growing scientific illiteracy of the US public, a problem that may well be contributing to its skepticism toward science. Nearly half of the precollege math and science teachers in the US are not properly certified.[45] And the typical grade school student in this country receives only one hour of science education a week.[45]

Goldsmith suggests that a major restructuring of educational systems to emphasize the interrelationships of the natural sciences, social sciences, and arts and humanities will be required before politicians and the general public can appreciate, and understand, the value of science.[20] While I agree that a major change such as that suggested by Goldsmith may well be needed to counter the widespread view of science as a world unto itself, for the immediate future I think there can be little dispute that the public needs more science education to deal with our technologically oriented society.

Finally, scientists should be asking themselves whether public skepticism toward science is valid. Perhaps, as Liebe F. Cavalieri, Sloan-Kettering Institute for Cancer Research, suggests, it is time to reexamine our assumptions about research, and ask ourselves whether the research we are doing addresses society's most pressing problems.[46] Do we, indeed, have a "laissez-faire granting system that is good for science but poor for linking scientific in-

terest and social need," as Daniel S. Greenberg, editor and publisher of *Science & Government Report*, claims?[47] If we don't ask ourselves these questions, and make our answers known, then we may have to live with the research priorities set by people who may not be in sympathy with the scientific establishment.

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