VOLUME XIX NUMBER 4
SUMMER 2003

The National Academies

The University of Texas at Dallas

ISSUES
IN SCIENCE AND TECHNOLOGY

20th Anniversary

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ISSUES IN SCIENCE AND TECHNOLOGY (ISSN 0748-5492)
Published quarterly by The University of Texas at Dallas, P.O. Box 830688, Mail Station J030, Richardson, TX 75083-0688. An equal opportunity/affirmative action university.

Subscriptions: Rates for U.S. subscriptions: $46 (individuals) or $92 (institutions); foreign $70 (individuals) or $110 (institutions). Inquiries or communications concerning new subscriptions, subscription problems, or single-copy sales should be sent to Customer Service, ISSUES IN SCIENCE AND TECHNOLOGY, P.O. Box 661, Holmes, PA 19043; or by phone to 800-345-8112; or by e-mail to issuessn@utdallas.edu. Periodical postage paid in Richardson, Texas, and additional mailing offices.

Postmaster: Send changes of address to ISSUES IN SCIENCE AND TECHNOLOGY, The University of Texas at Dallas, P.O. Box 830688, Mail Station J030, Richardson, TX 75083-0688.

Editorial Correspondence: By mail to the address above, by e-mail to kfinnera@nas.edu, or call (202) 965-5648.

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ISSUES IN SCIENCE AND TECHNOLOGY maintains a Web site at http://www.issues.org.

ISSUES IN SCIENCE AND TECHNOLOGY is indexed in the *Readers' Guide to Periodical Literature, Engineering Index, Public Affairs Information Service, Cambridge Scientific Abstracts, Science Citation Index, and Current Contents/Engineering, Technology & Applied Sciences.*

Looking Back, Looking Forward

"There is a troubling disparity between the scientific sophistication of our culture and its social and political backwardness, a disparity that hovers over every aspect of our civilization," wrote Daniel Yankelovich 20 years ago to begin the first article in the first *Issues in Science and Technology*. This is exactly the problem that National Academy of Sciences President Frank Press had in mind when he wrote in that same issue that this new magazine would be "dedicated to the broadening of enlightened opinion, reasoned discussion, and informed debate of national and international issues in which science and technology play a critical role."

We are delighted to have Yankelovich back to kick off this special 20th-anniversary issue. He and all the other authors in this issue are revisiting topics that they wrote about previously in *Issues*. (A list of these articles can be found on the following page, and the articles themselves are available at www.issues.org.) Our goal is to provide readers with a quick overview of the wide range of topics that have been tackled in our pages and a sense of how critical concerns in science, technology, and health policy have evolved. But if you're looking for a simple coda that will sum up the experience of the past two decades, you've come to the wrong place.

This edition, like all editions of *Issues*, has no party line. When one asks a group of very knowledgeable and politically savvy individuals from all sectors of society to express their personal views on a wide variety of contentious and important subjects, uniformity is the last thing one should expect. Reading these articles could leave one surprised, delighted, or dismayed. Every issue is different.

In some cases, the original problem continues unabated and the recommendations for action unchanged. In other cases, what might first appear to be the same problem is in fact quite different because of scientific developments or political shifts, so the recommendations for action are also different. Some authors have seen their recommendations become policy. In some cases, the result has been what they hoped; in others, it's back to the drawing board. Some problems are worse, others better.

In all cases, we have learned something. Although it often seems to people in the science, technology, and health communities that their expertise is given little weight in policy debates, that is not the case. Policymakers are aware that special expertise is necessary to understand many of the choices they must make, and the scientists, engineers, and physicians that have become involved in public policy understand that their contribution is only one of many factors that contribute to the formulation of wise policy.

Politics and science each have long histories. The integration of science, technology, and health expertise into public policy is a recent and rapidly evolving phenomenon. We hope that this quick review of policy developments and Yankelovich's perceptive overview will provide useful insights not only into the individual topics but also into the way in which expert knowledge can most effectively be used to inform public policy. To an increasingly large extent, humanity's future course will be determined by how well these realms work together.

Winning Greater Influence for Science

Daniel Yankelovich

In this space 20 years ago, I reported on the unwritten social contract between scientists and society: an unspoken agreement that gives science a "creative separateness from involvement with goals, values, and institutions other than its own." My conclusion then was that "To an impressive extent, [science's] … insistence on autonomy has worked brilliantly," although the contract came with a huge, though hidden, price tag.

This "social contract" has allowed science to pursue long-term fundamental questions and to build slowly on the basis of its new knowledge. Science has been able to do this even in the context of a society such as ours, which in most domains is impatient, excessively pragmatic, and thinks only in the short term. But this same social contract is responsible for the widening disparity between the sophistication of our science and the relatively primitive state of our social and political relationships.

Now, 20 years later, both the successes and the price tag of this social contract have grown. Science has reached greater heights of sophistication and productivity, while the gap between science and public life has grown ever larger and more dangerous, to an extent that now poses a serious threat to our future. We need to understand the causes of the divide between science and society and to explore ways of narrowing the gap so that the voice of science can exert a more direct and constructive influence on the policy decisions that shape our future.

Daniel Yankelovich is chairman of Viewpoint Learning, Public Agenda, and DYG, Inc.

The great divide

In today's public domain, scientists are highly respected but not nearly as influential as they should be. In the arena of public policy, their voices are mostly marginalized. They do not have the influence due to them by virtue of the importance and relevance of their work and of the promises and dangers it poses for our communal life.

Among the many reasons for science's lagging influence, the major one is difficult to engage directly, because it is so elusive. The unfortunate reality is that scientists and the rest of society operate out of vastly different worldviews, especially in relation to assumptions about what constitutes knowledge and how to deal with it. Scientists share a worldview that presupposes rationality, lawfulness, and orderliness. They believe that answers to most empirical problems are ultimately obtainable if one poses the right questions and approaches them scientifically. They are comfortable with measurement and quantification, and they take the long view. They believe in sharing information, and their orientation is internationalist because they know that discoveries transcend borders.

The nonscientific world of everyday life in the United States marches to a different drummer. Public life is shot through and through with irrationality, discontinuity, and disorder. Decisionmakers rarely have the luxury of waiting for verifiable answers to their questions, and when they do, almost never go

to the trouble and cost of developing them. Average Americans are uncomfortable with probabilities, especially in relation to risk assessment, and their time horizon is short. Policymakers are apprehensive about sharing information and are more at home with national interests than with internationalism. Most problems are experienced with an urgency and immediacy that make people impatient for answers; policymakers must deal with issues as they arise and not in terms of their accessibility to rational methods of solution.

This profound difference in worldview manifests itself in a many forms, some superficial, some moderately serious, and some that cry out for urgent attention. Here are three relatively superficial symptoms of the divide:

In today's public domain, scientists are highly respected but not nearly as influential as they should be.

Semantic misunderstandings about the word "theory." To the public, calling something a "theory" means that it is not supported by tested, proven evidence. Whereas a scientist understands a theory to be a well-grounded explanation for a given phenomenon, the general public understands it as "just a theory," no more valid than any other opinion on the matter. (Evolutionary "theory" and creationist "theory" are, in this sense, both seen as untested and unproven "theories" and therefore enjoy equivalent truth value.)

Media insistence on presenting "both sides." When this confusion over "theory" bumps up against media imperatives, the result is often a distorting effort to tell "both sides" of the story. In practice, this means that even when there is overwhelming consensus in the scientific community (as in the case of global warming), experts all too often find themselves pitted in the media against some contrarian, crank, or shill who is on hand to provide "proper balance" (and verbal fireworks). The resulting arguments actively hinder people's ability to reach sound understanding: Not only do they muddy the public's already shaky grasp of scientific fundamentals, they leave people confused and disoriented.

Science's assumption that scientific illiteracy is the major obstacle. When faced with the gap between science and society, scientists assume that the solution is to make the public more science-literate—to do a better job at science education and so bring nonscientists around to a more scientific mindset. This assumption conveniently absolves science of the need to examine the way in which its own practices contribute to the gap and allows science to maintain its position of intellectual and moral superiority. In addition, on a purely practical level a superficial smattering of scientific knowledge might cause more problems than it solves. Two other manifestations of the divide are less superficial and more serious:

The craving for certainty about risk and threat. The public and policymakers crave a level of certainty that the language and metrics of science cannot provide. For example, when the public is alarmed by something like the anthrax scare or some future act of small-scale biological or chemical terrorism, science will assess the threat in the language of probabilities. But this metric neither reassures the public nor permits it to make realistic comparisons to other threats, such as nuclear terrorism. Science's frame of reference does not communicate well to the public.

Divergent timetables. The timetables of science (which operates in a framework of decades or longer) are completely out of synch with the timetables of public policy (which operates in a framework of months and years). It has taken nearly 30 years for the National Academy of Sciences to complete its study of the consequences of oil drilling in Alaska's North Slope; in that time, a great deal of environmental damage has been done, and political pressure for further exploration in the Arctic National Wildlife Refuge has gained momentum. At this stage, the academy's scientific report stands to become little more than a political football. Vaccine research is another example: Political demands for prompt action on high-profile diseases do not jibe well with the painstaking process of research and trial. Political pressures push resources toward popular or expedi-

ent solutions, not necessarily those with the greatest chance for long-term success.

Two more manifestations of the divide are particularly troublesome:

The accelerating requirement that knowledge be "scientific." In both the academic community and Congress, the assumption is growing that only knowledge verified by scientific means (such as random assignment experiments) can be considered "real knowledge." Unfortunately, only a minuscule number of policy decisions can ever hope to be based on verified scientific knowledge. Most public policy decisions must rely on ways of knowing—including judgment, insight, experience, history, scholarship, and analogies—that do not meet the gold standard of scientific verification. Our society lacks a clear understanding of the strengths and limitations of nonscientific ways of knowing, how to discriminate among them, and how they are best used in conjunction with scientific knowledge. Since the time of the ancient Greeks, our civilization has presupposed a hierarchy of knowledge, but never before have forms of nonscientific knowledge been so problematic and devalued, even though they remain the mainstay of policy and of everyday life.

Colliding political and scientific realities. Although the scientific framework demands that scientists maintain objectivity and neutrality, political leaders pressure scientists to produce the "correct" answers from a political point of view. When political and scientific imperatives collide, science is usually the loser. President Reagan's science advisors on antiballistic missile systems found themselves marginalized when they didn't produce the answers the administration wanted. Scientists do not have a lot of experience in dealing with political pressures in a way that permits them to maintain both their integrity and their influence. Arguably, this has been the greatest single factor in science's declining influence in policy decisions.

Nor are these the only symptoms. A host of other elements exacerbate the divide between the two worlds: unresolved collisions with religious beliefs, difficulty in assessing the relative importance of threats, the growing number and complexity of issues, and the wide array of cultural and political differences in society. The overall result is a dangerous exclusion of the scientific viewpoint from political and economic decisionmaking at the very time when that viewpoint is most urgently needed.

Bridging the divide

These are impressive hurdles, but they can be surmounted if the will to do so is strong enough and if we follow two core principles. The first is that the initiative to bridge the gap must come primarily from the scientists' side rather than the policymakers' side, for reasons both of motivation and of substance. Scientists have the stronger motivation to take the initiative, because they know how important their input can be, and they are aware of the dangers posed by their loss of influence. In addition, scientists have an advantage regarding the substance of policy when scientific matters are at issue, because their mastery of the material makes it easier for them to integrate scientific and nonscientific content than for policymakers to do so. After all, as concerned citizens, scientists live in the policy world along with everyone else. But most policymakers are far removed from the world of science.

The second core principle is that scientists' efforts must not be confined to engaging policy elites but must extend to the general public as well. In our democracy, no major initiative can succeed without broad public support, which can be especially challenging to garner for proposals that require sacrifice or changes in lifestyle. Further, in many policy arenas the only way to offset special interest lobbying is to mobilize the public against it.

I see two strategies for bridging the divide: one for repairing lost influence at the top of the policy hierarchy and the other for engaging the public on important science-laden issues.

To regain influence at the top, reposition and reframe the science advisory function, shifting from the narrow role of science specialist to the broader role of framer of policy options. In recent years, scientists have increasingly been relegated to the "specialist" sidelines. There was a time, however, when scientists' voices were heard and heeded at the highest levels of policymaking. When the Massachusetts Institute of Technology's James Killian served as President Eisenhower's science advisor in the 1950s, the two men forged a close and mutually respectful working relationship. This proved to be the pinnacle of science's influence in U.S. policymaking circles.

In many ways, Killian's advisory role to Ike resembled McGeorge Bundy's advisory role as John F. Kennedy's national security advisor and "options czar" more than it resembled that of any current presidential

science advisors. Instead of offering a specialist's perspective, Bundy exercised his influence by controlling the process of framing and presenting policy options for presidential action. Bundy was scrupulous about doing justice to policy options with which he disagreed, but he was also able to make the strongest possible case for his own point of view. Kennedy knew that Bundy was a strong-minded and determined player, not just a technical advisor; at the same time he also trusted Bundy to make a fair case for options other than his own.

In contrast, today's scientists, operating mainly in specialist mode, do not address the key question troubling political leaders: for all policy options under consideration, what relative weight to give to the various specialists' perspectives and how to balance them against political considerations. The more technical the scientific input, the less its relevance to policymakers' most basic concerns.

Scientists need techniques for framing policy options that give the proper weight to their scientific content in relation to nonscientific variables and political realities.

The role of technical advisor also places scientists in a political bind by forcing them to resort to advocacy or frustrated silence when they strongly disagree with policy decisions, thus risking their professional integrity and their political credibility. (Issues readers will be able to supply all too many examples.)

To break out of the specialist box, scientists need techniques for framing policy options that give the proper weight to their scientific content in relation to nonscientific variables and political realities. Such techniques of policy option presentation not only frame the technical aspects of an issue but also develop a range of scenarios of likely consequences that take into account relevant nonscientific perspectives: social, economic, cultural, geopolitical, military, etc. By drawing on these various perspectives, fully acknowledging the merits of each and framing policy options accordingly, the policy option presentation technique gives scientists a way to upgrade their role while also performing the specialists' function. Even more, it provides a politically acceptable vehicle for advocacy: Those who control the option-framing process can make the strongest possible case for their own point of view, provided that they are willing and able to do full justice to points of view with which they may personally disagree.

To better engage the public, shift from the goal of "science literacy" to the goal of reaching sound "public judgment" on scientific issues, and use specialized forms of dialogue to advance this goal. Although framing options for top-level decisionmakers is a necessary condition for winning greater influence, it is not sufficient. Important policy changes also require broad-based public support. At present, though, the voters are largely disengaged, reluctantly abandoning decisions that affect their lives to experts they do not trust. Scientists hold the key to breaking the deadlock, at least on science-laden issues. But to do so, they need to rethink the goals and strategies of public engagement.

Part of the problem, as mentioned earlier, is that scientists persist in thinking that the goal of public engagement is to raise the level of scientific literacy. This assumption misses the point. Citizens do not need to be second-hand scientists. But they do need to be able to make sound judgments about science policy choices, ranging from global warming and genetically modified foods to nuclear proliferation and human cloning.

Bringing about sound public judgment requires two distinctly different steps. The first is to get the issue onto the forefront of the public agenda, endow it with urgency, and present a range of choices for dealing with it. The second, more difficult, step is to engage the public with sufficient intensity and focus to achieve resolution.

Our society has excellent mechanisms for the first step: placing issues before the public. The media, as well as political and civic leadership, are highly skilled at raising awareness of key issues, as can be

seen in the increased public concern about global warming. Awareness by itself, however, is not enough. All too often, the media beat the drums for an issue, get people aroused, and then abandon it for the next issue, leaving the public hanging and the issue unresolved. Moving people beyond awareness to judgment and resolution is far more arduous. It requires considerable "working through" as the public seeks to reconcile possible courses of action with their own deeply held beliefs and habits.

Global warming, for example, is stalled at the threshold of this phase: Awareness of the issue is growing, but thus far the public has resisted coming to terms with the tradeoffs involved in any serious solution. Should we permit an international agreement such as the Kyoto treaty to constrain our domestic policies? Is a push for alternative fuels worth the high cost of the investment? Should our control of carbon dioxide emissions be so stringent that it limits economic growth? The public must come to judgment on these and similar questions of values before any sustainable policy can be put into place.

Unfortunately, our society lacks effective institutions for taking this second step, especially on science-laden issues. The media are not equipped to do it, nor are most political leaders, who operate through advocacy rather than through encouraging the public to make up its own mind. Scientists, however, are potentially well equipped for this task. With a certain amount of instruction and experience, a small cadre of scientists could, if sufficiently determined to do so, establish a new, more robust model of public engagement.

This model would adapt for the general public the strategy of framing policy options described earlier. The scientists' role would be twofold. First, they would formulate a range of policy options and scenarios for science-laden issues, paying special attention to the pros and cons of each and keeping in mind the public's primary concern: how does this affect me, my community, and my world? Then scientists would collaborate with experts in public dialogue in presenting these scenarios to random samples of citizens. A number of organizations (my own company among them) have developed innovative methods for accelerating the working-through process with citizens. We utilize special forms of dialogue that encourage participants to engage issues with unprecedented depth and intensity. These special citizen dialogues predict the likely direction public opinion will take once the larger population has understood the tradeoffs associated with complex scientific issues. These citizen dialogues give leadership the insight into public priorities and values they need in order to engage the full electorate.

A new career path

Science is one the very few fields where individuals make major contributions at a young age. Thus, many scientists find themselves at a crossroads relatively early in their careers. Most choose to continue as working scientists, but others are ready to consider attractive alternatives. I believe that the role of scientist as bridge builder and policy formulator offers an appealing alternative for those drawn to top-level decisionmaking and the give and take of public life. For those with a conceptual bent, this alternative would be far more attractive than administrative work.

Top-flight working scientists are ideal candidates for this kind of high-level policy involvement. Not only can they provide a depth of expertise that is sorely lacking in generalists' discussions of scientific issues, they can also help their scientific colleagues understand the importance of nonscientific perspectives to their own work and the future of their field.

Many scientists will probably prefer to keep their focus on their scientific work, and others will find shifting back and forth between their own worldview and that of the larger society not worth the effort. But with even a small, committed cadre of high-level scientific thinkers, I believe that science can once again make itself heard about the issues that affect our collective future, both at the policymaker level and the level of public discourse. In doing so, they will be making an innovative contribution to our society. Indeed, if we are to avoid disaster, we have no choice.

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