

Science, Slogans, and Civic Duty

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We are beset with slogans for complex and controversial public issues that represent significant bodies of scientific knowledge. Public debate and action on these issues rarely adequately reflect such knowledge and seldom feature scientists playing central roles. Examples are assessment of educational effectiveness through assessment of student learning outcomes and the setting of scientific priorities across the full spectrum of scientific disciplines. It is an unfulfilled civic duty of scientists and engineers to engage themselves more fully and actively in public debate and action on important issues.

MY TITLE IS A BIT OF A SHAM. I DON'T INTEND TO TELL you anything about science. I do want to share with you some thoughts about what I've chosen to call "slogans," single words that allude to the many short, curt verbal triggers we are in the habit of using to signify complex ideas and issues that we do not have time to explain—and that we might not be able to explain even if we had the time.

What I really want to talk about is civic duty. I am a little embarrassed about trying to do that. I fear "civic duty" may sound archaic and charmingly irrelevant in this sophisticated modern world. One might think of it as just a slogan itself. But I have become convinced that it lies at the root of a damaging disjuncture between the community of scientists and engineers and the society in which this community is embedded. I will argue that the disjuncture and the damage are the result of our failure to do our civic duty. I will argue that we need to find individual and collective means, and the will, to do our duty. And I will argue that the AAAS can provide a means to that end, if we have the will to use it.

Let me turn first to slogans. Here are a few from recent years:

- Accountability
- Assessment
- Fraud, waste, and abuse
- Scientific freedom and integrity
- Set scientific priorities
- Save the environment
- Global change
- The information age
- The post-industrial age
- Economic competitiveness
- Technology transfer
- Leverage
- Cost-sharing
- Science and engineering manpower
- Science literacy
- Numeracy
- Educational reform
- Politically correct

- Zero risk
- The global marketplace
- Multiculturalism
- Scientific creationism
- Animal rights
- Pro-life, pro-choice
- No new taxes

That is a list that I am sure anyone could double or triple, with ease. I suspect anyone could find a favorite issue or two on it. I do not intend to discuss each slogan on this list; I simply wish to contend that each of these slogans has the following characteristics:

- 1) The slogan labels a complex and controversial public issue.
- 2) The issue has an underlying corpus of scientific knowledge that is, or should be, an essential feature of the public debate on the issue.

3) With few exceptions, the public debate is shaped and controlled by opinion-makers and civic leaders who are not scientists and who rarely have a comprehensive perspective on the relevant body of scientific knowledge.

4) By choice or by necessity, those who have such a perspective are usually cast in the roles of costume consultant, prompter, stage-hand, or spear-carrier, rather than director or lead soprano.

5) When the time comes to move from debate to action, action is shaped by the perceptions and values of the leaders of the debate. Sometimes these perceptions and values reflect the relevant body of scientific knowledge, and sometimes they do not.

The last of these characteristics is, I believe, both a simple statement of fact and a fundamentally important feature of democratic society. Action on a matter of public interest is necessarily political action. Political action is necessarily determined by the perceptions and values of the "polis," the people, as these perceptions and values are reflected by those who represent the people, whether duly elected or self-anointed. That is as it should be. It is what gives truth to the adage, "Perception is reality." Societal reality is, in the end, determined by societal perceptions through the political process, regardless of whether those perceptions are grounded in fact. And that, unfortunately, is what gives truth to that other adage, "Only in politics are facts negotiable."

This has been a hard lesson for many scientists to learn. In a sense, the behavioral adaptations that have made us so successful in untangling the rich tapestry of nature and reaping the benefits of the knowledge thereby gained have also rendered us ill-adapted to the process of transforming societal perceptions and values into societal reality. In science, fact yields perception, not the other way around. To the engineer, it is the laws of thermodynamics and the properties of materials that matter most, not perceptions about the jet engine one would like to have. The neurosurgeon treating a patient afflicted with a brain tumor will certainly have feelings about the case, but these feelings are surely less important than what the surgeon knows and thinks about the case and the skill with which the surgeon deals with it.

One might develop from such observations a picture of a species of scientists and engineers, admirably specialized to a particular and highly valuable societal niche, but intrinsically and inevitably isolat-

ed from the societal mainstream by its own evolutionary adaptation. We could simply accept this picture and be content with it. Should we? I think not.

In his recent book, Bok (1) raises essentially this question in the context of the university:

It is fair to ask whether our universities are doing all they can and should to help America surmount the obstacles that threaten to sap our economic strength and blight the lives of millions of our people.

This question raises two separate issues. The first is whether universities, especially our research universities, are doing enough to meet the many challenges that affect our ability to maintain a growing, competitive economy while providing adequate security and opportunity for all our citizens. In other words, are these universities contributing as much as they can to help society enjoy efficient corporate management, technological progress, competent government, effective public schools, and the conquest of poverty with its attendant afflictions of crime, drug abuse, alcoholism, and illiteracy? The second issue is moral in nature and recognizes that the revitalization of our corporations, our government agencies, our schools, and our urban areas is ultimately dependent on the values of individual citizens. Since values are so decisive, are our universities doing enough to build in our society—especially among its most influential members and leaders—a strong sense of civic responsibility, ethical awareness, and concern for the interests of others?

Bok answers his question about universities in the negative, as I have mine about science and technology, and about scientists and engineers. Our universities and our science and engineering community can and must become more centrally and fully engaged with the great societal issues represented by the slogans I have listed and many others.

This is in many ways an uncomfortable prospect. To be engaged is to be vulnerable. The canonical ivory-tower university and the traditional scientific priesthood, above the fray, have much to recommend them. Nevertheless, Bok argues for universities, and I would argue for scientists and engineers, that the times demand much more. We must engage ourselves. It is our civic duty.

Let me now return to my list of slogans. Consider the first two items on the list, “accountability” and “assessment.” In most of our states and their public universities, assessment of institutional performance through assessment of student learning outcomes has been a hot topic for nearly a decade because accountability has become a popular watchword. A public university should be accountable to the people who fund it. The university should be able to demonstrate that it performs its functions effectively and efficiently.

Astin (2) has listed some questions, the answers to which might be expected to form part of such a demonstration:

- 1) How effectively are institutions using the money we already give them?
- 2) How much are students really learning?
- 3) Are they learning what we expect them to learn?
- 4) Are they developing the talents and skills needed by our state’s economy?
- 5) Are they developing the values and habits of citizenship that will make them responsible and caring parents, spouses, and members of the community?
- 6) Are they developing the kind of leadership qualities that will help them to become productive and effective professionals, teachers, politicians, and government officials?
- 7) What about the students who fail to complete their programs? What good has higher education done for all these dropouts? Are institutions doing all they can to address this problem?
- 8) Are we using the most current teaching techniques?
- 9) How effective and efficient are our institutions in comparison to private institutions in other states?
- 10) How effective are our teacher-training programs?

These questions are all about teaching and learning because the public perceives a university’s primary function to be the education and training of its students. One could ask similar questions about

a university’s performance of its other functions, research and service, but the focus of public attention has been on the teaching function and on developing means for assessing an institution’s effectiveness and efficiency in performing this function. Usually, this has been taken to mean a need for assessing the educational “value added” by the university to its students.

Astin’s questions have been asked more often and more pointedly by individuals and organizations outside of universities than by those inside. Politicians—legislators and governors—have been particularly prominent questioners. The governors, for example, provided a major impetus for the assessment movement in a 1986 report of the National Governors’ Association (3). The regional accrediting associations have also weighed in; all of them now require colleges and universities to have some kind of student learning outcomes assessment as a condition of accreditation.

The most interesting aspect of Astin’s questions is that I do not think we know how to answer them in any fundamental sense. We do answer them, of course, because answers are demanded. Universities provide a few file cabinets’ worth of statistics from institutional research offices, accompanied by assurances that they are doing a terrific job of teaching their students. Various pundits, including a former Secretary of Education and a few from the universities, answer by asserting that the universities are doing a lousy job of teaching their students. None of us, in my opinion, can really back up our claims with credible, scientifically convincing evidence.

At this point, I find myself venturing into terra incognita, but it seems to me that at the root of the assessment issue there are fundamental scientific questions about the cognitive and social development of human beings. These are difficult questions about a complex and multidimensional process. I imagine that cognitive, behavioral, and social scientists have learned a great deal about this process and that they can tell us a lot about what we can measure—and what we cannot measure—that will help us to assess the effect of an educational program or institution on the development of individuals or groups. I am confident that there exists a significant and substantial body of scientific knowledge on which we could build systems for assessing the effects of our educational institutions on the development of their students. However, I do not see much evidence of this body of knowledge in the arenas where the tough questions about the effectiveness and efficiency of our educational institutions are being asked and answered and where the answers are being translated into political and economic action.

This is unfortunate, because there is much at stake. First and foremost is the ability of our children and grandchildren to function, perhaps even to survive, in a world in which knowledge and skill are the keys to success. Also at stake are the continued vitality and viability of our educational institutions.

What seems to be missing is engagement between those who understand and those who must act. The assessment debate is not being shaped by a scientific understanding of what is and is not feasible in attempting to assess the effects of educators on those being educated but by the urgent and entirely proper desire of our citizenry for assurance that those effects are maximally positive and minimally costly. It is clear what is wanted. It is far less clear how to provide it or even whether it can be provided.

Who is to blame for this unsatisfactory state of affairs? There is enough blame for all concerned to share, but I believe this assessment issue is an example of the failure of our scientific community to do its civic duty. We should not concede center stage in the assessment debate to our political leaders. Our scientific leaders should be there too. They should be there not because the outcome of the debate might affect the narrow self-interests of the scientific and educational communities but because it will surely affect the greater and more important interests of our society as a whole.

In advocating engagement in pursuit of our civic duty, I am well aware that such engagement requires a willingness to accept risk, both individual and collective. It is neither easy nor safe. The role of the objective and disengaged observer and critic is far more comfortable than the role of the engaged participator. There is a big difference between coaching or playing in the Super Bowl and analyzing the game from the press box. If science and technology are as critical to the nation's welfare as we say they are, then scientists and engineers need to be in the game, not on the sidelines.

Another of the slogans on my list, "Set scientific priorities," is usually viewed by scientists in the context of the fierce competition within the community for a share of the resources available to science. This intramural competition sets "big science" against "little science" and one discipline against another. It engenders chronic reexamination of the faults and virtues of the peer-review system. It pits peer review against the time-honored political process called the "pork barrel." We are told that if scientists cannot be realistic, acknowledge resource limitations, and set their own priorities, then someone else will, probably politicians.

We seem to find it difficult to meet this challenge. Some years ago, while I was at the National Science Foundation, Congress pressed the NSF to explore how the effectiveness of its research support programs might be evaluated. Is it possible, for example, to determine whether a program in one discipline has, over time, made the best use of its funds to advance the state of the discipline? Has one disciplinary program done a better job of that than another?

The NSF responded by funding a National Academy of Sciences (NAS) committee to examine one disciplinary program and to see whether there were output indicators that could be used to assess the effectiveness of the program. The essence of the committee's conclusions was that such an evaluation would be a difficult and complex task and that there probably is no good way to accomplish it. I believe that is true. Nevertheless, it leaves us in the curious position of arguing that an NSF research support program can assess the probable quality of research before it is performed, using its proposal review process, but cannot adequately assess the aggregate quality of the research after it is performed.

More recently, the process of setting scientific priorities has been brought to the fore by NAS President Frank Press and by others. The issue has not been enthusiastically embraced and confronted by the scientific community as a whole, but there may be some hope.

In January 1991, the Council of the American Physical Society (APS) issued a position statement on physics funding and the Superconducting Super Collider. The statement addresses the question of the relative priorities of individual investigator research in physics and the major physics research facility currently under construction. While asserting the importance and necessity of both, the statement assigns higher relative priority to individual investigator research.

The APS Council's statement is couched in carefully crafted language and falls short of being a ringing manifesto. Nevertheless, it is a remarkable statement simply because it exists. The press release accompanying the statement begins by noting that the adoption of this public statement on funding priorities is the first action of its kind by the APS Council in the 93-year history of the APS.

There are other examples of priority-setting within disciplines. For example, astronomers have long engaged in setting priorities for construction of major astronomical facilities. But there are not many such examples. There are even fewer examples of interdisciplinary priority-setting by the scientific community.

We cannot afford to avoid this issue, unpalatable though it may be, for two reasons. The first is that it is very much in the self-interest of scientists and engineers to do everything possible to optimize the use of whatever resources may be provided to us by society. The second, and more important, is that it is our civic duty to bring to bear the full power of science and technology in the service of society. To do so, we must strive to do the best we can with the resources we have and we must win the resources we need to do for society what society demands of us.

In that second objective is the answer to another question. Beyond our intramural competition for resources is another and larger competition, the competition between us and all other claimants on the nation's resources. This competition pits us against the sick and the elderly, against the urgencies of national security, and against a host of special interests. How are we to justify more money for science, in the face of such competition? How important is lifting the morale of researchers compared with the necessity of salvaging the nation's banking system?

We do ourselves and the nation a disservice when we argue these questions in terms of the health of the scientific enterprise. Science and the technology it spawns are important for what they contribute to enhancing the quality of human life. To engage ourselves in the struggle for the resources and conditions needed to strengthen the capacity of science and technology to perform that essential function is hardly narrow self-interest. It is our civic duty.

Finally, allow me to indulge in some personal remarks about the AAAS. The AAAS is unique in the United States and the world as a voluntary association of scientists, engineers, and others, an association that spans the full spectrum of science, engineering, and the science-based professions. My service on the AAAS Board has convinced me that the AAAS has an enormous and heretofore only partially realized potential for providing the science and engineering community with the means to do its civic duty, as I have tried to define it here. Realizing that potential, however, would require thinking about the nature and purposes of the AAAS in a different way. I think most of us have thought of the AAAS as an organization intended to serve the needs of scientists and engineers. Its very name refers to the advancement of science. I would like to suggest that we might collectively contemplate what the AAAS might become if we were to think of the "S" as representing "society," as well as "science."

I am not proposing that we change the name of the AAAS, not yet, at least. I am proposing that we explore whether the AAAS might come to see itself as an institutional vehicle through which we could collectively become more engaged in doing our civic duty.

I am aware that this could imply substantial, perhaps profound, changes in what the AAAS does and how the AAAS operates. It could be argued fairly that such changes might destroy a great organization, if carried too far. Nothing could be further from my intent. But, as I look around at the means our science and engineering community has for bringing its ideas and talents to bear on the great public issues of our time, for engaging itself with those issues, for doing its civic duty, I see nothing remotely as well suited to this purpose as the AAAS.

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