Appendix B

Public Attitudes Toward Science*

The attitudinal environment for science includes the attitudes of the public toward science and technology in general or institutional terms. These attitudes may be usefully grouped as hopes and expectations, reservations and concerns, and confidence in the leadership of the scientific community. This appendix will examine both the literature and the data relevant to each of these three sets of attitudes.[1]

Hopes and Expectations

In broad strokes, the literature and the publication data from the 4 decades since 1945 portray a public that has a high regard for the past achievements of science and technology and high hopes for even more spectacular results in the future. Even though most Americans still see science as a magic black box, ' the evidence is clear that they also believe that their current standard of living is in large part the result of modern science and technology. The substantial gains in medical science, for example, symbolize the achievements of science for most Americans.

The first national study of public attitudes toward science in the post-war years was conducted in 1957 by the Survey Research Center of the University of Michigan. Sponsored by the National Association of Science Writers (NASW) and the Rockefeller Foundation, the study was designed to assess the public's interest in and knowledge about science and technology, the major sources of information on current science issues, and the appetite of the public for science news. The study included personal interviews with a national probability sample of 1,919 adults and the field work was completed in early October 1957, just 2 weeks prior to the launching of Sputnik I. Inadvertently, the 1957 NASW study became the only existing set of measures of the attitudes of the American public toward science prior to the beginning of what is often termed the Space Age. The study offers, therefore, a unique opportunity to look back to the calm of the mid-1950s.

The 1957 NASW study found a public that believed that science and technology had won the war, created "miracle" drugs, and would continue to produce a cornucopia of benefits for American society.[3] Almost 90 percent of the American adults polled said that the world was "better off because of science. " When asked why they thought so, slightly more than half cited medical advances and about 40 percent pointed to the American standard of living. When asked to name some potential "bad effects" of science, 90 percent of the adults in the study could not think of a single possible negative effect. Ninety-four percent of the population were willing to agree that science was making their lives "healthier, easier, and more comfortable. " Ninety percent agreed that "most scientists want to work on things that will make life better for the average person" and 88 percent felt that science was "the main reason for our rapid progress. " It would be hard to imagine a more supportive public,

Despite the influence of the space race and the continued growth of post-war science and technology,

*This appendix is based on an OTA contractor report written by Jon D. Miller, Northern Illinois University.

'The following data sources were utilized in secondary analyses. The 1957 National Association of Science Writers study was based on personal in-home interviews with a national probability sample of 1,919 Americans. The interviews were conducted by the Survey Research Center at the University of Michigan. The field work for this survey was completed just prior (about 2 weeks) to the launch of Sputnik 1 by the Soviet Union and is the last measurement of American attitudes toward science and technology prior to the Space Age For a full description of the study and results, see R.C. Davis, *The Public Impact of Science in the Mass Media,* Survey Research Center monograph No. 25 (Ann Arbor, MI: University of Michigan, 1958).

The 1979 survey of public attitudes toward science and technology was based on personal In-home interviews of a national probability sample of **1,635** adults. Sponsored by the National Science Foundation (C-SRS78-16839), the field work was conducted by the Institute for Survey Research at Temple University. For a description of the design and results of the study, see Jon D Miller, et al , *The Attitudes of the US. Public Toward Science and Technology* (Washington, DC. The National Science Foundation, **1980)**

The 1981 survey of public attitudes toward science and technology was based on telephone interviews with a national probability sample of 3,195 adults The study was sponsored by a grant from the National Science Foundation (NSF 8105662) and was conducted by the Public Opinion Laboratory at Northern Illinois University. For a description of the sample and results, see Jon D Miller, *A National Survey of Public Attitudes Toward Science and Technology* (DeKalb, IL Northern Illinois University, 1982).

The 1983 survey of public attitudes toward science and scientists was based on telephone Interviews with a national probability sample of 1,630 adults, Sponsored by the Annenberg School of Communications at the University of Pennsylvania, the survey was conducted by the Public Opinion Laboratory at Northern Illinois University. For a description of the design and results of the study, see Jon D. Miller, *A National Survey of Adult Attitudes Toward Science and Technology in the United States* (Philadelphia, PA: University of Pennsylvania, Annenburg School of Communications, 1983),

The 1985 data on attentiveness to science policy were taken from a telephone survey of a national probability sample of 1,514 adults. The study was sponsored by *Family Circle* magazine and conducted by the Public Opinion Laboratory at Northern Illinois University, A technical report on this study will be released by the Public Opinion Laboratory in the fall of 1985,

The 1981-82 study of the attitudes of science policy leaders was based on telephone interviews with a national sample of 282 individuals, Sponsored by a grant from the National Science Foundation (NSF 8105662), the survey was conducted by the Public Opinion Laboratory at Northern Illinois University. For a description of the study design and the methods used to identify and sample science policy leaders, see Jon D, Miller and Kenneth Prewitt, "National Survey of the Non-Governmental Leadership of American Science and Technology, " a report to the National Science Foundation, 1982,

'Jon D. Miller, "Scientific Literacy: A Conceptual and Empirical Review, " *Daedalus* vol. **112**, No. **2, 1983,** pp. 29-48,

'Davis, op. cit.

there were few efforts made in the 1960s to measure public attitudes toward science. The next systematic effort to assess the attitudes of the American people toward science and technology was initiated by the National Science Board (NSB) in 1972. As a part of its new Science Indicators series, the NSB decided to include a chapter on public attitudes toward science. The NSB staff prepared a set of questions and used the Opinion Research Corporation to collect national data sets in 1972, 1974, and 1976.

These NSB surveys found a public that still held science and technology in high regard, although less so than in 1957. In contrast to the almost 90 percent of the public that thought in 1957 that the world was "better off" because of science, only 70 percent of the public held the same view in 1972. ' Similar results were obtained in the 1974 and 1976 studies.[5] While the absolute level was down somewhat, a substantial majority of the total public held very positive views of the contributions of science to American society.

In a 1979 national study of public attitudes toward science and technology, also sponsored by NSB, several of the 1957 questions were repeated, offering an opportunity for comparison across 2 decades. In 1979, 81 percent of the public still agreed that scientific discoveries were making their lives "healthier, easier, and more comfortable" and 86 percent expressed the view that scientific discoveries were "largely responsible" for the standard of living in the United States. ' In a comparable national study in 1983, Miller found that 85 per cent of American adults continued to agree that science made their lives healthier, easier, and more comfortable. [7]

Although the material gains attributable to science have undoubtedly influenced public attitudes toward science, there is evidence that Americans also have a commitment to the value of science *per se.* In a 1983 national survey, Louis Harris found that 82 percent of American adults agreed that scientific research "which advanced the frontiers of knowledge" was worth supporting "even if it brings no immediate benefits.'" Only 14 percent of Americans rejected this idea.

Evidence from the European Barometer indicates that western Europeans hold very similar views about the positive contributions of science and technology to their standard of living.[9] (See table B-l.) Approxi-

Table B-1 .—European Attitudes Toward Science, 1978

Country	Percent agree
Northern Ireland	800/0
United Kingdom	79
Italy. ., .,	76
France .,	75
Ireland	75
West Germany	71
Luxembourg ., ...	70
Denmark. ...	67
Belgium	66
Netherlands .	65

"Science will continue in the future as it *has done in the past to be one of the most important factors in improving our lives. "*

mately threequarters of western Europeans were willing to agree with a statement that science had been and would continue to be a major factor in improving their lives. There was a high degree of consensus among countries, ranging from 80 percent in Northern Ireland to 65 percent in the Netherlands.

Another facet of the attitudinal environment for science is reflected by the public's expectations for future achievements. The belief that science has contributed to the health and comfort of the society is, of course, inherentl, retrospective; and so it is important to inquire whether the public expects similar achievement from science in the future, or whether the public thinks that the frontiers of science have been explored thoroughly. Beginning with the 1979 study for NSB, one series of questions have asked respondents to assess how likely it is that science will achieve certain results in the next **25** years. The results indicate that a large segment of the public holds high expectations for future outcomes from science and technology. By 1983, a majority of the public thought that it was "very likely" that within the next 25 years science would find a cure for the common forms of cancer, have people working in a space station, and find efficient sources of cheap energy (see table B-2).

In contrast, a substantial portion of the public indicated that they did not expect science to be able to cure mental retardation, communicate with alien beings, or put whole communities of people into outer space. These results indicate that the public does have some ability to differentiate between likely and less likely outcomes and that the optimism found in several previous responses is not a simple yea-saying reaction.

From these aggregate results, it would appear that a significant portion of the American people hold some positive general attitudes toward science. It is also important to inquire whether the attentive public* for

'National Science Board, *Science Indicators—IQ72* (Washington, DC 1973)

'National Science Board, *Science Indicators—1974* (Washington, DC. 1975); and National Science Board, *Science Indicators* — 2976 (Washington, DC 1977)

'Miller, et al , op cit

"Miller, *A National Survey of Adult Attitudes Toward Science and Technology in the United States,* op cit

"Louis Harris 'The Road After 1984. The Impact of Technology on Society, a report prepared for the SOu them New England Telephone Company, 1984

°Jacques-Rene Rabier *Euro-barometer 10a Scientific Priorities in the European Community October-November, 1978* (Ann Arbor MI. Inter-University Consort] urn for Political and Social Research 1981)

*In brief, the basic dimensions of an 'attentive public" for science policy are high level of interest in the topic, combined with the perception of being adequately informed For a discussion of this concept in more depth, see Jon D Miller, Public Attitudes Toward the Regulation of Research, contractor report prepared for the U S Congress, Office of Technology Assessment

Table B-2.—Expectations for Future Scientific Achievements, 1979-83

Percent saying that the following results will be achieved in the next 25 years:	Year	Very likely	Possible, but not too likely	Not likely at all	Number of people surveyed
A cure for the common forms of cancer. . . .	1979	46	44	8	1,635
	1983	57	36	6	1,630
A cure for mental retardation	1983	11	*40*	*47*	1,630
A way to put communities of people in outer space	1979	17	38	42	1,635
People working in a space station	1983	52	34	12	1,630
Humans communicating with alien beings .	1983	14	33	51	1,630
More efficient sources of cheap energy	1979	57	34	7	1,635
A safe method of disposing of nuclear wastes	1983	29	41	26	1,630

"Now let me ask you to *think about the long-term future. I am going to read you a list of possible scientific results and ask you how likely you think it is that each of these will be achieved in the next 25 years or so. "*

science policy shares these same positive views of the past and future results of science. Fortunately, the national data sets collected in 1957, 1979, 1981, and 1983 are available for retabulation for this purpose.

The one question relevant to this section of the analysis that has been asked repeatedly throughout the last 3 decades has been the agree-disagree statement concerning the contribution of science to making our lives "healthier, easier, and more comfortable. " A retabulation of three previous studies indicates that there has been some decline in the proportion of both the attentive public and other citizens willing to agree with the statement, but **9** of 10 members of the attentive public for science policy and 8 of 10 other Americans still hold that belief (see table B-3). At all three measurement points, at least 10 percent more of the attentive public were willing to agree with this view than were other citizens.

Some of the more recent data sets allow an examination of the difference in expectations between those who follow science policy matters and those who do not. In general, people who were attentive to science policy issues were more optimistic about the future achievements of science and technology than *were* those who were nonattentive (see table B-4). The general pattern of expectations by the attentive public and by the others did not differ significantly.

In summary, both the existing literature and selected retabulation of available data indicate that most Americans have a positive image of science and/or scientific research. Those who have a high level of interest in science and who feel reasonably well informed about it tend to hold even more positive views about the past and future benefits of science.

Reservations and Concerns

Throughout the post-war years, there has been some level of wariness about some of the possible negative effects of science among a substantial minority of the American people. On balance, these reservations have not offset the high levels of positive affect and expectation described above, but it is necessary to review and understand the magnitude and substance of these attitudes.

The 1957 NASW study found some reservations about the effects of science, but it was muted and most often accepted as the price of gaining good things from science. Slightly over **40** percent of the public were willing to agree that science "makes our way of life change too fast" and 23 percent agreed with the statement that "one of the bad effects of science is that it breaks down people's ideas of right and wrong. " Although 70 percent of the adults in the 1957 study agreed that "the things that happen in this world are mostly controlled by God" and about half felt that "one of our big troubles is that we depend too much on science and not enough on faith, " when asked to assess the net effect, 9 out of 10 concluded that the world was better off because of science. There was

Table B.3.—Attitude Toward Contribution of Science, by Attentiveness, 1957.83

	Year	Attentive public	Not attentive	Number surveyed: Attentive	Number surveyed: Not attentive
Percent agreeing that science makes our lives healthier, easier, and more comfortable	1957	980/o	930/0	183	1,736
	1979	89	79	232	1,313
	1983	92	82	398	1,232

Table B-4.–Expectation for Future Achievements, by Attentiveness, 1979-83

Percent saying it is "very likely" that the following results will be achieved in the next 25 years:	Year	Attentive public	Not attentive
Ž A cure for the common forms of cancer, ...	1979	55 "/0	44
	1983	68	54
• A cure for mental retardation	1983	13	10
• A way to put communities of people in outer space	1979	13	10
• People working in a space station	1983	62	49
• Humans communicating with alien beings.	1983	17	13
• More efficient sources of cheap energy	1979	76	53
• A safe method of disposing of nuclear wastes	1983	35	27
N (1979) =		307	1,328
N (1983) =		398	1,232

"Now let me ask you to think about the long-term future. I am *going to read you a list of possible scientific results and ask you how likely you think It is that each of these will be achieved in the next* 25 years or so.

some wariness, but not enough to offset the desire for increased health and comfort.

Karen Oppenheim repeated some of the 1957 NASW items in a national survey conducted by the National Opinion Research Center in 1964 and found that the level of public wariness or concern was increasing .'" The NSB-sponsored studies in the early 1970s found the same trend.

Four of the items originally used in the 1957 NASW study were replicated in a 1983 survey sponsored by the Annenberg School of Communication at the University of Pennsylvania. " A comparison of the results indicates that the reservations expressed by those citizens included in the 1957 study have remained largely unchanged over the last quarter century.

The concern over the impact of science on the pace of change in society has also continued at virtually the same level. In both years, about 4 in 10 Americans expressed some concern that science was causing our lives to "change too fast" (see table B-5).

[8]Karen Oppenheim Acceptance and Distrust Attitudes of American Adults Toward Science, master s thesis University of C hicago, 1966
[11]Miller *A National Survey of Adult Attitudes Toward Science and Technology in the United States* op c it

Table B-5.— Public Concerns About Science, 1957.83

	Year	
	1957	1983
• We depend too much on science and not enough on faith	500/0	500/0
• One trouble with science is that it makes our way of life change too fast	43	44
• The growth of science means that a few people could control our lives .	3 2	35
. One of the bad effects of science is that it breaks down people's ideas of right and wrong	23	29
Number.	1,919	1,630

Finally, these data indicated a persistent public concern about the potential for a few people to control the lives of the total society, using the power of science. In both years, about one-third of the adult population was willing to agree with the statement that the "growth of science" meant that a few people could "control our lives. "

Recent studies indicate a renewed concern about the tie between science and weapons. A 1983 national survey by Harris found that 74 percent of adults in the United States were willing to agree with the statement that "with the development of nuclear, chemical, and biological weapons, science and technology may end up destroying the human race."[12] Another 1983 study found that one-quarter of the adult population thought that it was very likely that "wars in space" would occur in the next **25** years and an additional 36 percent of the American people thought that space wars were "possible.'"

Do people who pay more attention to science (the "attentive public") have the same kinds of reservations as those reviewed above? A retabulation of the 1957 and 1983 data indicated that the attentive public holds many of the same reservations found in the previous data, but that the proportion of persons holding those reservations is slightly lower among the attentive public than other people (see table B-6). Although 4 in 10 members of the attentive public were concerned that society depends too much on science and not enough on faith, only 2 in 10 felt that science tended to break down people's ideas of right and wrong. The proportion of the attentive public concerned about changes in the pace of life and in the loss of the control of their lives to science did not differ significantly from the proportion for the nonattentive public.

[12]Harris op cit
[1]Miller *A National Survey of Adult Attitudes Toward Science and Technology in the United Stales* op cit

Table B-6.—Concerns About Science, by Attentiveness, 1957-83

	Year			
	Attentive		Not attentive	
Percent agreeing that	1957	1983	1957	1983
• We depend too much on science and not enough on faith	440/0	430/0	50%	53 "/0
• One trouble with science is that it makes our way of life change too fast	34	36	44	48
• The growth of science means that a few people could control our lives . .	31	31	32	38
• One of the bad effects of science is that it breaks down people's ideas of right and wrong	16	24	24	32
Number	183	321	1,736	1,309

In summary, from the literature and from selective retabulation of previous data, it appears that a substantial portion of the American people hold some reservations about the impact of science on society. In the context of the very positive views found in the preceding section, it would appear that a significant portion of the American people recognize and understand that science involves both the potential for substantial benefits and the possibility of damage or misuse.

Confidence in Science

Given the combination of positive hopes and expectations and the simultaneous level of concern, how does the public reconcile these attitudes? Is there an overall view of science? In general terms, the attitude research data from the last three decades suggest that people have concluded that the benefits outweigh the potential harms from organized science in the United States.

As noted earlier, **88** percent of the adults studied in 1957 reported that they felt that the world was better off because of science,[14] The preceding analyses have demonstrated that the level of concern was as high in 1957 and in the early 1980s. The conclusion that the world was still better off for the contributions of science could be interpreted, therefore, as an assessment that the benefits outweighed the past and prospective risks.

[14]Ibid.

Beginning in the 1970s, the surveys sponsored by the NSB asked each respondent to make an assessment of the relative benefits and harms and to weigh the two. Similar questions have been asked since that time by Cambridge Reports. 's

The data from the last 15 years indicate that a solid majority of Americans believe that science does more good than harm (see table B-7). Only about 1 in 20 Americans believe that science does more harm than good, but about one-third of U.S. adults are unsure as to where the balance falls. Some of this uncertainty may reflect a lack of interest or information. About 5 percent of current respondents are simply unable to answer the question.

Although the exact items discussed above have not been used in a survey that would allow the separation of attentive and nonattentives for analysis purposes, the 1983 Annenberg study did include two items that reflect the same attitude. Each respondent was asked to agree or disagree with the statement that "the benefits of science outweigh whatever harm it does. " Two-thirds of the attentive public agreed with the statement in comparison to **55** percent of nonattentives.[16] The same sentiment was measured with a paired statement worded in the other direction. When asked to agree or disagree with the statement that "science is likely to cause more problems than to find solutions, " only 16 percent of the attentive public and 27 percent of the nonattentive public agreed. These results suggest that those who are interested in science issues and who follow science policy matters believe that the benefits of science outweigh its potential harm. This same view is reflected in the larger public, but it is not likely to be as solidly rooted in the larger population as it would be in the attentive public.

A second approach to reconciling the potential for good and harm. from science is reflected in measures of confidence in the leadership of organized science. Most Americans have considerable pressure on their time and do not normally set aside a significant portion of time to consider the flow of issues in areas like science policy. If people (especially those attentive to science) have confidence in the leadership of major scientific organizations and corporations, then the leaders can be relied on to monitor the process and the public can wait until a real controversy emerges before becoming concerned about the issue.

The evidence from the General Social Survey[17] indicates that the leadership of the scientific community

[15]National Science Board, *Science Indicators*— 1984 (Washington, DC: 1985).

[16]Miller A *National Survey of Adult Attitudes Toward Science and Technology in the United* States, op. cit,

[17]J. A Davis and T. Smith, *General Social Surveys 1972-1984: Cumulative Code Book* (Chicago, 11.: National Opinion Research Center, 1984).

has been and continues to be held in high esteem (see table B-8). The only major institution in American society that has consistently claimed a high level of confidence from more Americans has been medicine, which may be viewed as at least closely related to the scientific community.

In summary, the literature and the reanalysis of previous data can be interpreted to indicate that most Americans see the benefits of science as greater than any potential harms or risks. This view is apparently held even more firmly by the attentive public for science policy. The evidence may also be interpreted to indicate that the leadership of the scientific community is held in high regard, implying a degree of trust in their monitoring of the work of organized science. But it should be noted that no major survey to date has specifically addressed the philosophical and political issue of direct regulation of scientific research. Episodes such as those discussed in chapter 7—and the existence of considerable congressional legislative activity resulting in regulation—can be interpreted just as strongly as indicators of, if not a lack of trust, at least a wariness on the part of some communities and constituencies.

Table B-7.— Public Assessment of the Risks and Benefits of Science, 1972-85

Science and technology . . . . . Year	do more good than harm	do more harm than good	do about the same amount of each	dent know/ not sure	Number
1972 ...., ...	54	4	31	11	2,209
1974 ..., ...	57	2	31	10	2,074
1976 .., ...	52	4	37	7	2,108
1983. , ...	73	3	21	3	1,466
1984. , ...	63	5	27	5	1,864
1985. , ...	58	5	32	5	1,866

"Overall, would you say that science and technology do more good than harm, more harm than good, or about the same amount of each?"

SOURCES Opinion Research **Corp.** (1972 1974 1976), Cambridge Reports (1963, 1984, 1985)

Table B-8.– Public Confidence in Science and Selected Other Institutions, 1973-84

Have a "great deal of confidence" in:	1973	1974	1975	1976	1978	1980	1982	1984
Medicine ., ...	54	60	50	56	46	52	46	52
Scientific community	37	45	38	43	36	41	38	47
Education	37	49	31	37	28	30	33	29
Organized religion	35	44	24	30	31	35	32	32
Military	32	40	35	39	29	28	31	37
Major companies	29	31	19	22	22	27	23	32
Press	23	26	24	28	20	22	18	17
Television	19	23	18	19	14	16	14	13
Organized labor	15	18	10	12	11	15	12	9
Executive branch	29	14	13	13	12	12	19	19
Congress	23	17	13	14	13	9	13	13
Supreme Court.	31	33	31	35	28	25	30	35
N =	1,504	1,484	1,490	1,499	1,532	1,469	1,506	943

"I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them ?"

SOURCE James A. Davis and Tom W Smith General *Social Surveys Cumulative File,* 1972-1984 (Ann Arbor Inter-University Consortium for Political and Social Research, 1984), p 152