

## ATTITUDES TOWARD TECHNOLOGY AND SCIENCE IN A BIBLEBELT CITY

Alexander Nesterenko and Douglas Lee Eckberg, Tulsa University, Oklahoma

### INTRODUCTION

In recent years the crisis of science is thought to derive from waning public approval for science and technology (Gingerich 1975). This contradicts the view of some historians that the American public by tradition, equates science with progress (Rosenberg 1961; Handlin 65). Even so, such general approval would not necessarily indicate approval for specific technological and scientific issues. Others propose that the purported crisis of science is not a general anti-science crisis, but instead, consists of various controversies (David 1980; Hannay, Nunn 1974; Shils 1974). Opinion surveys reveal that the public is ambivalent. Despite general approval for science, there is evident disapproval and misunderstanding on some specific technological and scientific issues, which leads to speculation that the public may lack any coherent structure of opinion on these issues (Etzioni, Nunn 1974).

Previous studies have concentrated on general affect toward technology and science or on specific issues, without demonstrating a clear structure of public opinion (Mazur 1977; Taviss 1972; Goldman, Platt, Kaplan 1973; LaPorte, Metlay 1975; Anderson, Lipsey 1978). The southern Biblebelt region has not been studied. Several prior samples have been drawn from the west coast and from the northeast. Historically, demographically, and economically, the southern Biblebelt region has been the locus of several conservative movements, including some against secular scientific trends (Kahn 1974; Watkins, Perry 1974; Numbers 1982; Lo 1982; Thompson 1975).

### PURPOSE AND METHOD

Earlier research suggests that the public is generally confident of science. Despite a decline in public confidence toward most social institutions, in recent years, science has risen to rank above government, business, and labor unions, and just below medicine (Mazur 1977). Our purpose is: 1) to measure general opinions on technology and science in a Biblebelt setting; 2) to measure opinions on specific technological and scientific issues.

Of particular interest are issues thought to concern the Biblebelt region, namely, evolution and genetic engineering, which are anathema to many socially conservative groups. Finally, past studies suggest that public opinion is likely to be multidimensional. We will apply factor analysis to establish a structure of opinion on technology and science.

We surveyed a sample of adults of the metropolitan area of Tulsa, Oklahoma, which has many social, economic, and political characteristics prominent in recent controversies over technology and science. Tulsa has a high technology economy in petrochemicals, aeronautics, and information processing. It is dominated by powerful evangelical religious institutions. With a metropolitan population of about 500,000, it is one of the larger cities in the Biblebelt, of which it claims to be the "buckle." Concern is evident in that the Oklahoma legislature did not pass a "creation science" law because to do so would have required equal time for evolution science (Godfrey 1981). Tulsa is preparing for a major controversy over a proposed nuclear power plant. Finally, the city is situated near several highly polluted waste disposal sites, one of which was called the worst in the nation by the U.S. Environmental Protection Agency.

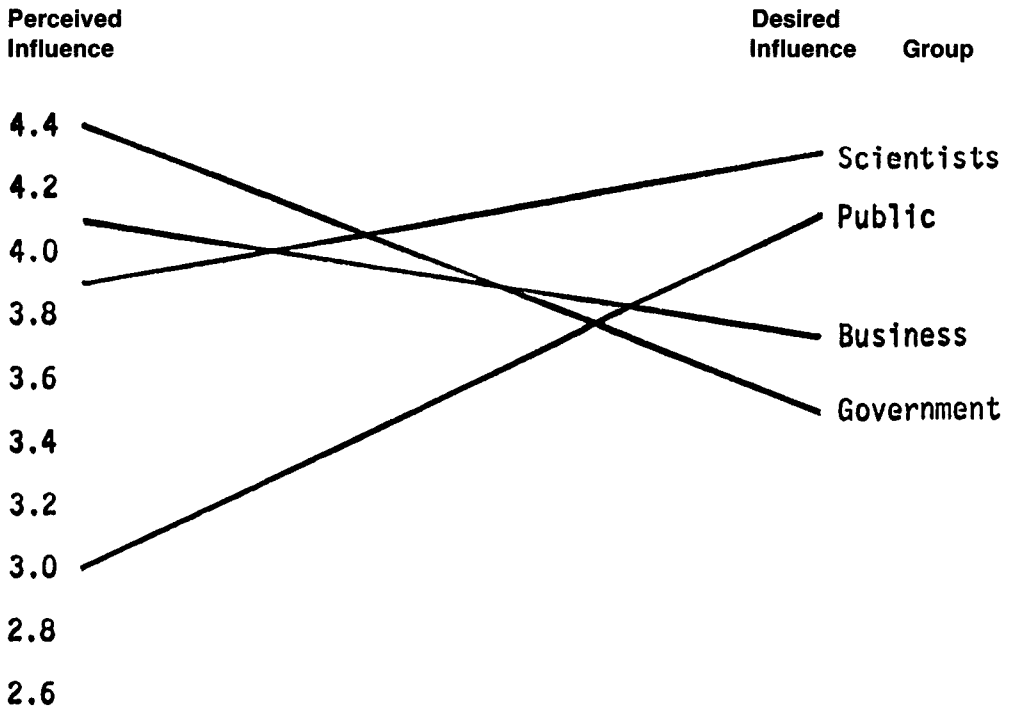
Trained telephone interviewers administered a 39-item questionnaire which we developed, to 308 respondents. These respondents constituted 54 percent of those contacted for an interview. Our findings suggest that respondents do not clearly distinguish between technology and science, as is the case in earlier studies, so we use the combining term, *tech-science*.

### RESULTS

**General Opinions.** Initially, strong approval was given for both technology and science: 89 percent said that tech-science is important, or very important in their lives; and 85 percent said that tech-science has made the world better; 74 percent agreed that tech-science should be encouraged, and not controlled. Only 4 percent thought that tech-science is dangerous, and that it should be closely

**FIGURE 1: PERCEIVED INFLUENCE IN TECHNOLOGICAL DECISION MAKING**

(Scale 1-5. All groups: For difference between *perceived* and *desired*,  $p = .001$ )



controlled. They also thought that scientists should have more influence in decision making about technological advances than at present, and more influence than the government, business, or even the public should have, as shown in Figure 1, where the rating differences for all four groups is significant at the .001 probability level.

With respect to the general affect, this Biblebelt sample is similar to samples from other regions of the country in its strong approval of technology and science.

**Specific Issues.** Approval of tech-science is also extended to such specific issues as nuclear energy, the space program, and modern methods of contraception. Striking exceptions occur regarding genetic engineering and laetrile, where from 22 to 51 percent of the respondents are unsure about their acceptability and appropriateness, as shown in Table 1.

On other issues, respondents disagreed with established scientific opinion or they were uncertain. Thus, 44 percent thought that some

questions should *not* be pursued by science compared to 41 percent who thought that science should be permitted to explore freely. In open-end questioning it was typical for respondents to point out that investigation into human origins, genetic engineering, and the like should not be continued. And 72 percent agreed that there is a "moral crisis" in the world today, while 33 percent thought that science is culpable, or were unsure of the complicity of science in the moral "crisis."

To determine the extent to which the respondents grant authority to scientific opinion, they were asked to judge two issues on which there is no substantial difference of opinion within science: 1) Is astrology a science? 2) Is evolution theory valid? Accepting astrology as a "science," or rejecting evolution theory, or uncertainty about the two would suggest a marked departure from opinion in the science community. And 48 percent either accepted or were unsure about the scientific validity of astrology, and 60 percent rejected or were unsure on evolution theory.

**TABLE 1: PUBLIC OPINION OF TECHNOLOGY**  
(Percent)

Technology Items	very bad	some bad	un- sure	some good	very good
Nuclear energy	8	11	22	36	23
Fertilize in vitro	32	21	23	19	5
Laetrile	8	11	53	22	6
Genetic engineering	21	15	38	17	9
Space program	3	6	9	36	46
New contraception ways	7	7	10	29	48

**TABLE 2: OPINION ON SOCIAL MOVEMENTS AGAINST TECHNOLOGY** (Percent)

Social Movement	dang- erous	bad	un- sure	good	valu- able
Against Nuclear Power	9	22	31	25	13
Against Pesticides	4	20	31	34	11
Against Supersonic Transport	6	27	40	22	5
Against Genetic engineering	5	20	39	28	8
Favor Government Control of Pollution	6	26	15	38	15

Respondents were also questioned about various anti-technology movements pertaining to nuclear energy, pesticides, the supersonic transport plane, genetic engineering, and the movement favoring government control of pollution. The results appear in Table 2. The plurality of respondents favored all of these movements except the movement against supersonic transport. However, more than 30 percent of the sample was unsure about the four anti-technology movements.

**TECHNOLOGY DECISION MAKING**

In technology decision making, government and business were thought to have the greatest influence, with scientists third and the public fourth. When asked how much influence each of these groups *should have*, the rankings were almost reversed, as shown in Figure 1. Moreover, 75 percent of the respondents indicated that the public *does not* have sufficient knowledge about technology and science. Thus, the data suggest an image of an alienated public. The respondents

desire control, but recognize their lack of power and information. They think that power resides in dominant national institutions.

**STRUCTURE OF OPINIONS TOWARD TECHNOLOGY AND SCIENCE**

**Factor Analysis of the Data.** Factor analysis of the 29 opinion items yielded 9 principal axes with eigenvalues of 1.00 or greater. Varimax rotation was applied and it accounted for 58 percent of the total variance in the 9 factors. These factors have clear structure, with only three items receiving substantial secondary loadings. Items were assigned to factors on which they had at least  $\pm .40$  loadings, including 2 items which fell slightly short of this criterion. Of the 9 varimax factors, 3 were omitted because each included only one item. The three excluded items were: 1) appropriateness of modern methods of contraception; 2) validity of astrology as a science; 3) validity of laetrile as a treatment for cancer.

The six remaining multi-item factors can be called either "operative" or "nominal," because they appear to be derived from the similarity and placement of items, and therefore, are probably dependent on the construction of the questionnaire. These are therefore eliminated from further discussion.

And factors 2, 5, and 6 are defined as "operative" because they include diverse items, and appear not to be significantly dependent on instrumentation. See Table 3.

**Operative Factors.** Factor 2, *Life Processes* is defined by 6 items pertaining to social and living systems: in-vitro fertilization, genetic engineering, the social movement against genetic engineering, areas of inquiry that science should avoid, the validity of evolutionary theory, and the existence of a "moral crisis." We interpret Factor 2 as follows: Those who approve of in-vitro fertilization will approve of genetic engineering, disapprove of social movements against genetic engineering, not believe that areas of inquiry should be avoided, regard evolution theory as valid, and reject the idea of "moral crisis." Factor 2 suggests the current controversies, particularly that of creationism, which often divide evangelical Christians from other Americans. However, it is important to note that the *life process* theme is not associated with other public opinions about tech-science. Factor 2 indicates that

**TABLE 3: MAJOR FACTORS IN OPINION TOWARD TECHNOLOGY AND SCIENCE**

Factor Names	Items	Loadings
1. Influence in technology decision making	public influence	.68
	business influence	.71
	government influence	.70
	scientists' influence	.61
	desired public influence	.56
	desired business influence	.68
	desired government influence	.72
	desired scientist's influence	.61
2. Life Processes	approve in-vitro fertilization	.72
	approve genetic engineering	.79
	movement against genetic engineering	-.53
	Are there areas to leave alone?	-.60
	Is evolution valid?	.45
	Is there a moral crisis?	-.51
3. Social Movement against Technology	approve nuclear technology	-.51
	movement against nuclear energy	.80
	movement against pesticides	.63
	movement against supersonic transport	.54
	movement against genetic engineering	.35
	favoring government control of pollution	.58
4. Action Stance toward Science and Technology	general regard for technology	.81
	general regard for science	.86
	Has tech-science made the world better?	-.45
5. Products of Science and Technology	Is tech-science important in your life?	.66
	approve of space program	.68
	Has tech-science made the world better?	.48
	Has science caused a moral crisis?	-.41
6. Public Power	desired public influence	.47
	Does the public know enough about tech-science?	-.70
	Is there a moral crisis?	.35

"creationism" is not necessarily part of a general movement against tech-science, but appears to be an independent aspect of evangelical belief. This underscores research showing that activists among "scientific creationists" tend to work in high technology industries and do not disapprove of these endeavors (Nelkin 1977 71).

Factor 5, *Products of Science and Technology* is defined by four items referring to the importance of tech-science in one's life, approval of the space program, whether tech-science has improved the world, and whether

science has brought about a "moral crisis." Persons affirming these items are likely to believe that tech-science is important, and that it has improved the world, and are likely not to believe that science has caused a "moral crisis." Because the space program has generated many consumer spin-offs, it appears that Factor 5 reflects approval for such scientific and technological innovation.

Factor 6, *Public Power* is defined by three items concerning how much influence the public should have in technology decision making, how much information the public has

about tech-science, and whether a "moral crisis" exists. This factor indicates that those who believe that the public should have greater influence are likely to believe that the public does not have sufficient knowledge about tech-science, and that a "moral crisis" exists.

## DISCUSSION

Our findings are similar to those obtained in other regions of the country. Ambivalence is indicated. Although tech-science is approved in general and respecting some specific issues, there is also substantial disagreement and uncertainty about about established scientific opinion. Acceptance of tech-science is not necessarily contingent on accurate understanding (Tobey 1971).

Disparity between public and professional conceptions of tech-science is inevitable, particularly in light of the heterogeneity of opinions and beliefs found in modern society (Berger, Berger, Kellner 1974). And there are influences contributing to public ambivalence. Dissemination of technological and scientific information is largely dominated by the mass media institutions, and not by the scientific community. Critics speculate that media preoccupation with discrete stories, rather than with continuing trends and processes results in fragmented public understanding. There may be other factors in public ambivalence and lack of an integrated conceptual structure about tech-science, but the mass media contribute to the situation.

Respondents do not have an organized structure of opinion toward tech-science, as is evident from the factor analysis of the data.

Factors 2, 5, and 6 illustrate patterns of opinion. Factor 2, *Life Processes* parallels recent efforts of activist groups to persuade and mobilize the public against in-vitro fertilization, genetic engineering, and evolution theory. Moreover, these issues are receiving considerable media attention. Thus, it seems that opinions toward tech-science may vacillate as groups vie for media attention and as various issues are presented as newsworthy.

Factor 5, *Products of Science and Technology* is largely defined by items that require only general opinions about tech-science. It may represent little more than

gratuitous approval for the consumer conveniences that arise from tech-science.

Finally, Factor 6 *Public Power* underscores the relation between the public and science. Neither is Factor 6 linked with an identifiable social movement, nor does it concern the material rewards of tech-science. Instead, it stresses alienation and detachment, and the desire for greater information and control, and perhaps, the respondents' desire for more organized understanding about tech-science.

## CONCLUSION

The data provides no evidence of regionalism in opinions toward tech-science. Evolution and genetic engineering are associated with the Life Processes factor. This suggests that issues pertaining to morality and the basis for human life are thought to be outside the domain of scientific inquiry. This wish to control and repudiate both the results and even the right to conduct scientific inquiry has often appeared in the history of fundamentalist Protestant and Catholic hierarchies.

From this, one would expect the religious fundamentalist regions of the country to be particularly rejective of the idea of evolution and the practice of genetic engineering. But in contrast to a recent National Assessment of Education Progress survey, our data show that the position of the Tulsa sample is no more hostile than that of the nation as a whole (Miller 1982). The even split in the sample on the question of evolution is commensurate with the results of national surveys (Gallup 1977, 1981; Christianity Today 1979). This Biblebelt sample is actually somewhat more accepting than are the British on the issue of evolution (Current Opinion 1973).

Tulsa is a metropolitan center with high-technology industries tied to the national economy, which are expected to influence opinions toward tech-science. At the same time, Tulsa is dominated by major fundamentalist organizations, with 79 percent of the sample native to the region, 30 percent of the sample religiously fundamentalist, and 45 percent being politically conservative. Tulsa is characteristic of the Biblebelt, and the opinions of our respondents reflect opinions of the region.

## REFERENCES

- Anderson R W, M W Lipsey 1978 Energy conservation and attitudes toward technology. *Public Opin Qtrly* 42 17-30
- Berger P, B Berger, H Kellner 1974 *The Homeless Mind: Modernization and Consciousness*. New York. Random House
- Christianity Today 1979 The Christianity Today Gallup Poll. Dec 21. 23 12-19
- Current Opinion 1973 British Attitudes on a variety of ideas. July 7. 1 70
- David E E Jr 1980 On the dimensions of the technology controversy. *Daedalus* 109 169-177
- Etzioni A, C Nunn 1974 The public appreciation of science in contemporary America. *Daedalus* 103 191-205
- Gallup Opinion Indexes: 1977, 1981 Religion in America 1977-1978. No 145; 1981. No 184
- Gingerich O 1975 *The Nature of Scientific Discovery*. Washington DC. Smithsonian Inst
- Godfrey L 1981 Newsletter No 1. Massachusetts Comm of Correspondence. Anthro Dept, Massachusetts U, Amherst.
- Goldman R D, B B Platt, R B Kaplan 1973 Dimensions of attitudes toward technology. *J Applied Psychol* 57 184-187
- Handlin O 1965 Science and technology in popular culture. 184-198 G Holton ed. *Science and Culture*. Boston. Beacon
- Hannay N B, R E McGinn 1980 The anatomy of modern technology: prolegomenon to an improved public policy for the social management of technology. *Daedalus* 109 25-53
- Kahn E J 1974 *The American People*. Baltimore. Penguin
- LaPorte T R, D Metlay 1975 Technology observed: Attitudes of a wary public. *Science* 188 121-127
- Lo C Y H 1982 Countermovements and conservative movements in the contemporary United States. *Ann Rev of Sociol* 8 107-134
- Mazur A 1977 Public confidence in science. *Social Studies of Science*. 7 123-125
- Miller J D 1982 Attitudes to genetic modification research. *Sci Technol & Human Values*. 39 37-43
- Nelkin D 1977 *Science Textbook Controversies and the Politics of Equal Time*. Cambridge Massachusetts. MIT Press
- Numbers R 1982 Creationism in 20th Century America. *Science* 218 538-544
- Pember D R 1981 *Mass Media in America*. 3rd ed. Chicago. Science Research Associates
- Perry E, L Watkins 1974 *The Rise of the Sunbelt Cities*. Beverly Hills California. Sage
- Rosenberg C E 1961 *No Other Gods*. Baltimore. Johns Hopkins U Press
- Shils E 1974 Faith, utility, and the legitimacy of science. *Daedalus* 103 1-15
- Taviss I 1972 A survey of popular attitudes toward technology. *Technology & Culture* 13 606-621
- Thompson J J Jr 1975 Southern Baptists and the antievolution controversy of the 1920's. *Mississippi Qtrly* 29 65-81
- Tobey R C 1971 *The American Ideology of American Science: 1919-1930*. Pittsburg U Press

## ST JOHN

## Continued from page 62

- Shevky E, W Bell 1955 *Social Area Analysis: Theory, Illustrative Application and Conceptual Procedures*. Stanford U Press
- Simkus A A 1978 Residential segregation by occupation and race. *Amer Sociol Rev* 43 81-92
- Sorensen A, K E Taeuber, R J Hollingsworth Jr 1975 Indexes of racial, residential segregation for 109 cities in the United States: 1940 to 1960. *Sociol Focus* 8 125-142
- St John C 1981 Residential segregation as an adaptation to increasing urban scale. Paper, Amer Sociol Assn Mtg.
- Taeuber K E, A F Taeuber 1965 *Negroes in Cities: Residential Segregation and Neighborhood Change*. Chicago Aldine
- U S Bureau of the Census  
1970 Census User's Guide. Washington DC USGPO  
1972a 1960 Census of Population and Housing Census Tract Summary Tape  
1972b 1970 Census of Population Summary Tapes, Fourth Count. File A (Tracts)
- Uyeki E S 1964 Residential distribution and stratification. *Amer J Sociol* 69 491-498
- Van Valey T L, W C Roof, J E Wilcox 1977 Trends in residential segregation: 1960-1970. *Amer J Sociol* 82 824-844
- Villemez W 1980 Race, class, and neighborhood: Differences in the residential return on individual resources. *Social Forces* 59 414-430
- Wilson G, M Wilson 1945 *Social Change: The Analysis of Social Change Based on Observations in Central Africa*. Cambridge England. The University Press