A STUDY OF THE ATTITUDES AND BEHAVIOR OF TECHNOLOGICAL DISSENT

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Technological innovations have always met with enthusiastic acceptance in the United States. For the last century and a half, an "ideology" asserting that technological development holds the key to progress has burgeoned here. Both foreign and domestic observers have often sought out the roots of this ideology and commented upon the American people's profound commitment to it. Even as early as 1830, Alexander de Tocqueville, for example, was struck by the preoccupation of the men of democracy with "practical applications of science." He noted that for those minds, "every new method which leads by a shorter road to wealth, every machine which spares labor, every instrument which diminishes the cost of production, every discovery which facilitates pleasures or augments them, seems to be the grandest effort of the human intellect."[1]

Encountering virtually no resistance, new technological systems were implemented which have affected practically every portion of society. Historians have documented, for example, how a system of slavery was made "economical" as a consequence of the cotton gin;[2] we have seen how the primary capacities of the railroads enabled the pioneers to push back the wilderness,[3] how automobiles have increased personal mobility and transformed the cities,[4] and how large data handling systems have organized and analyzed masses of information at rates heretofore unimagined.[5]

We shall primarily be concerned in this paper with the nature of political controversy surrounding the implementation of highly visible widely available technologies. We shall argue that the locus of such controversy is found in technology's second-order effects. Because the concept of such effects is often misused or left ambiguously defined, we shall first consider in some detail an extended example of second-order effects. While we cannot fully confirm that hypothesis here, we shall, next, provide some illustrations to suggest its plausibility. Then, we shall examine some public opinion data which provides a measure of the extent to which the public is aware of these second-order effects and of their willingness to forego those values associated with

technology's primary capacity in return for a reduction in its negative second-order consequences. Finally, we shall try to draw out the implications for policy and for democratic theory of these findings.

The impact which any technical innovation has can be fruitfully analyzed if we distinguish between the consequences anticipated from its primary capacity and those which derive from its unintended and unanticipated functions. By "primary capacity," we mean the set of functions for which a technology, implemented in a given way, is designed. Beyond these, it is apparent that consequences not initially programmed may accompany a technology's intended functions. These unforeseen consequences we will designate as secondary or indirect effects. It will often be years, even decades, after a technology has been implemented that its causal connection with such consequences becomes established.

The examples are legion which could be adduced to illustrate this distinction and, in so doing, provide referents for the conceptual framework of this paper. Setting aside the more dramatic technological advances like those in transportation and communications, let us consider for the moment the profound effects wrought by the introduction of a relatively prosaic technical capacity -- barbed wire.[6] This example is particularly powerful in showing how even an incremental advance in technology can have intense and far-reaching effects upon the social fabric.

The Case of Barbed Wire: An Historical Journey to Distinguish between the Primary and Secondary Effects of Technology

After the Civil War, many Texans returned home to find millions of fat, mature "longhorns" on the grassy plains in the southern part of the state. These could be purchased at roughly three dollars a head and sold for twenty times as much in the populated East. The lure of this profit influenced the Texans to herd the cattle northward to the western termini of the railroads. The drive was made possible by the existence of a belt of free pasturage extending from South Texas to the Canadian border. The cattle could travel unimpeded for 1200 to 1500 miles using common watering holes.

By 1871, the peak year of the drive, some 600,000 cattle were driven north. For much of that region, west of the Mississippi River from the Gulf of Mexico to Kansas and Nebraska, the cattle drive became a focus of activity, both social and economical. Cow towns such as Abilene and Dodge City grew and prospered, contributing to American culture such colorful figures as Wyatt Earp, Billy the Kid, and the ubiquitous cattle rustler.

By 1888, the cowboy of the long drive had begun to fade into legend; the cattle drives had become part of the past history of a rapidly changing region. Almost overnight, cattle and sheep ranches replaced the open range. What factors led to such an enormous change?

To be sure, the extension of the railroads and the murderous winter of 1886 contributed to the death of the drive. More than anything else, however, it was the rapid implementation of a new technology -- barbed wire -- that transformed the open range into ranch land. For while enclosure had been a common practice both in the United States and England for over a century, it had been a virtual impossibility on the prairie because of inadequate supplies of either wood or stone. Thus, the area had remained relatively underpopulated, there being no way to protect crops or even to establish the boundaries of property. Barbed wire altered all of this: barely five years after its invention, half a million miles of it were in use; less than a decade later, more than a million miles. This new invention had, in fact, provided a highly acceptable solution to the acute problem of fencing as the line of settlement pushed further west.

The anticipated consequences of this new capacity were manifold. It produced an incentive for the farmer to settle on the prairie without fear of loss of crops from damage by animals or ambiguity about his property rights. Cattlemen were forced to change their operation from transporting the beef to raising cattle for shipment via railroad. Those cattlemen who did adapt to the new conditions could use the wire to better manage their stocks. Moreover, there were direct economic benefits. For although some cattle were injured by the barbs, the wire radically

reduced theft and obviated the need for branding, which tended to reduce the value of each hide by more than two dollars. On the other hand, the cowboy became one of the first victims of "technological unemployment." Controversies arose between sheepmen and cattlemen over whether land should be enclosed and between the large ranchers and small stockmen who accused them of blocking passage to water holes, roads, and business centers.

The secondary consequences of the introduction of barbed wire were, if anything, just as numerous. Along with the new farmers came permanent settlers who were not engaged in agriculture. Commerce and industry came to the West. The breaking up of stock trails gave added impetus to the railroads. Some western cities built slaughter and packing houses, and some such financial institutions as boards of trade and loan companies. By 1889 many communities in the Panhandle had built small creameries, and irrigation had entered the scheme of southwestern agriculture. Land values skyrocketed in the face of this rapid development. Even cultural institutions were not immune from the impact of fences. A petition from some Kansas settlers stated, "[T]he fence in many instances runs so near the lands owned or occupied by actual settlers that it interferes with...further settlement of the public domain. ...And your petitioners would further state that the County is now so poorly settled that the present settlements are unable to enjoy Church and School privileges, and unless the County settles [more densely] your petitioners would be compelled to abandon...the cheering influences of the Church and School."[7] The implementation of barbed wire had indirect influence on the public morality as well. On the one hand, it reduced lawlessness in towns such as Abilene where the gun-slinging cowhand had formerly bullied and blustered unchecked. But on the other hand, it marked the beginning of violent struggles to obtain water rights and to gain possession of land -- often at the expense of the small farmer or stockman.

Finally, there were indirect consequences for the political system. Conflicts over the fencing of public lands raged in Congress. Lobbyists exerted strong pressure

to kill any measure which would harm the "cattle interests." The barbed wire "trust" became such an anathema to many farmers that they sought to revoke the manufacturer's patents. This antagonism eventually grew into a generalized attack on the entire patent system, which assumed such proportions that Thomas Edison felt compelled to intervene in its defense.

Given these numerous developments, it may readily be seen that the magnitude of the second-order consequences of barbed wire implementation can hardly be assessed.

Technology's Second-Order Effects as the Locus of Controversy Over Its Development

While it is often difficult to distinguish any given consequence of the implementation of technology as due either to its primary capacity or to a second-order impact, it is hoped that the above example will indicate that to make such a discrimination is not entirely arbitrary. We believe that the distinction has particular utility in informing the nature of controversies related to technology. We would argue that conflicts over the implementation and continued use of technological systems have largely been struggles over values enhanced by the primary capacity and those adversely affected by the indirect consequences. This is not to say, of course, that there is always a consensus about what values a new technology's primary capacity will affect. (Certainly the recent events surrounding the rejection of the SST bear strong witness to this point.)

Even a cursory reading of the social history of the late nineteenth century suggests that the vision of technology extended beyond its primary impacts. For some, a belief developed in the inevitable efficacy of technological innovation for solving social problems. Simon Patten of the Wharton School of Business, for example, saw man's progress intimately connected with the power he derived directly from machines: "The final victory of man's machinery over nature's [represents] the next logical step in [his] evolution..."[8] But perhaps the most complete nineteenth century vision of a future made civilized and humane through "technical solutions" is contained in Edward Bellamy's utopian novel, Looking Backward 2000 - 1887.[9]

In this fable, a Bostonian of the 1880's is projected into the future; leaving behind a world of industrial strife and chaos, he reenters it to find the fruits of technology being reaped by all. There is not even a hint that technology may carry with it some untoward side effects. Indeed, its only second-order consequence is that it serves to facilitate man's ability to co-exist harmoniously. It is this new found communion, significantly, that sets the new Boston off from the old. Solutions to the great problems of social reorganization, previously elusive, now lay within easy grasp. These solutions, the reader is told, "came as a result of industrial evolution which could not have terminated otherwise....The movement toward the conduct of business by larger and larger aggregations of capital, the tendency toward monopolies which had been so desperately resisted, was recognized at last, in its true significance, as a process which only needed to complete its logical evolution to open a golden future to humanity" (p.126).

But if some nineteenth century thinkers saw the indirect effects of the major technological innovation, industrialization, as a blessing, others perceived it as an unalloyed disaster. Ignatius Donnelly's novel, Caesar's Columns[10] stands in sharp contrast to Bellamy's. In Donnelly's vision, the fruits of technology's primary capacity are monopolized by an elite who use them to repress the masses. This novel quite accurately reflects an important strand of thought which emerged from the controversies during the Populist period: that an indirect consequence of increased industrialization was to redistribute wealth and power from the yeoman classes to the capitalist classes. Since technology was a crucial variable in the industrialization process, attacks on industry were often joined by attacks on technology itself. Yet, despite occasional demands that the process of industrialization be halted and intermittent yearnings for a return to a "lost agrarian Eden," the reformers accepted industrialization for the benefits it could bring if properly controlled. As Michael Rogin puts it, "Technology, the Populists argued, could be used to enslave man, but also to liberate him."[11]

The character of technological controversies has remained remarkably stable over the eightyyears intervening since the novels of Bellamy and Donnelly. While occasional disagreements have arisen over the need or utility of a particular new primary capacity, most of the intense conflict has resulted from technology's indirect consequences. Even optimists -- those who are most enthusiastic about the new possibilities technology creates for human choice and action -- readily concede the problematical quality with which those indirect consequences endow modern technological innovation. Emmanuel Mesthene, for example, comments that "the consequences of technology that are causing concern at the present time -- pollution of the environment, potential damage to the ecology of the planet, occupational and social dislocations, threats to the privacy and political significance of the individual, social and psychological malaise -- are negative externalities of this kind."[12]

An examination of recent controversies involving technology further strengthens the point that the key issue is how the tradeoff is to be made between the values adversely affected by technology's second order consequences, those "negative externalities," and those advanced by its primary capacity. The placing of fluorides in community water supplies was opposed not so much because people did not want to fight tooth decay but because they felt that a long range consequence would be socialized medicine. The use of pesticides has not been fought on the grounds that malarial vectors should not be destroyed, but on the grounds that the desired equilibrium of various ecological niches was threatened. The idea of a national data bank has met with hostile reaction not so much because people oppose better information bases for governmental or business decisions, but because they are afraid of the negative implications for individual privacy which this primary capacity would bring with it.

It is, in fact, toward this aspect of the debate over technologies -- their two-faced nature -- that most critics have turned. Negative second-order consequences of increasing magnitude have been an inevitable result of the implementation of any

widespread technological system because no account of them is taken beforehand; the basis of acceptance of the system rests only upon how well it fulfills its primary functions.

Jacques Ellul, in his often somberly pessimistic book, The Technological Society, speaks of the "automatism of technical choice." Efficient means will drive out inefficient means in almost a reversal of Gresham's Law. "There is no choice between two technical methods. One of them asserts itself inescapably: its results are calculated, measured, obvious, and indisputable."[13] Given this premise, the pessimists' argument proceeds as follows: Once a decision is made to undertake some task, the manner of implementing the technology to do it will be selected purely on the basis of the efficiency of the primary capacity. If, for instance, it is desired that crime be reduced and if electronic surveillance equipment and automated dossiers on every citizen are seen as the best way to achieve that end, then -- in Ellul's mind -- such technologies unquestionably will be implemented. Values advanced by the primary capacity subordinate others hurt by the secondary consequences; in the case just cited, the reduction of crime takes precedence over the protection of individual privacy.

There is considerable historical evidence to support such an outlook. Certainly in the United States there has rarely, if ever, been an instance in which a technical innovation has been abjured when it offered improved instrumental efficiency. Yet, there is increasing evidence that Ellul's automatism is not entirely inevitable. The victories gained recently by the environmentalists have occurred only because concern over second-order impacts has tempered the persuasiveness of the values of the primary capacity; construction of nuclear power plants, for example, has been halted in many places because of environmental concerns. Similarly, the defeat of the SST marked an important decision point: we did not build that plane, although we could have, in large part because the indirect costs in terms of noise, pollution, and destruction of the ozone layer were too high.

The dilemma created by the negative secondary impacts of technological development has become increasingly urgent in recent years. Impending technological catastrophe has been prophesied by thinkers such as Ellul. The problem is being debated with growing explicitness in the committee rooms of legislatures and in executive offices. Those involved in the agitation all claim to know the public mind which, they contend, is in substantial agreement with their position. Implicit in their debate is a point well made by Philip Converse:[14] "Democratic theory greatly increases the weight accorded to numbers in the daily power calculus. This increase still does not mean that numbers are of overriding importance; in the normal course of events it is the perception of numbers by democratic elites that is the more important factor. However this may be, claims to numbers are of some modest continuing importance in democratic systems for the legitimacy they confer upon demands."

With regard to this "numbers rationale," however, we know extraordinarily little about how the public views the questions of technological tradeoffs. Therefore, all claims by elites must be treated as problematical and subjected to a great deal of scrutiny. Some indicators of the public mind, however, do exist. In California, for example, concern over the second-order consequences of technology has grown to such proportions that measures dealing with them have been included on the ballots in the 1970 general election and the 1972 primary and general elections.

It is quite likely that this process of involving a broad constituency in questions dealing with the implementation of technology will accelerate in the future. In the face of such a politicization of technology it becomes a point of more than academic interest to assess the extent to which the public is prepared to forego the advantages of technology's primary capacities. For clearly its choice may determine whether Ellul's ominous forebodings become a reality.

A Study of Public Attitudes Toward Technology

In our recent research, we have tried to explicate the issue of technological controversy by filling in, through a statewide public opinion survey, some of the gaps in our knowledge of how the public regards technology. The instrument developed for our study sought opinions about a wide range of technology-related topics: the importance of technology as a feature of social change; evaluations of twelve specific technological capacities; criteria for technology assessment and control; technology's effect on the quality of life; and degrees of technology-related political activism. Data was also gathered on demographic, social, and political characteristics of the respondents. Pre-tests of the interview schedule were conducted in Northern California during June, 1972, by the Field Research Corporation. The interviewing was completed in early July. A total of 980 California residents from a random sample of all adult Californians was interviewed. In addition, data from another survey which had been taken in early May, 1972, and included 1200 respondents, was made available to us.[15] The demographic and political characteristics of both samples correspond closely to those of the nation as a whole.

As noted previously, our main concern in this paper is with the conflict between values deriving from a technology's primary capacity and those adversely affected by its secondary effects. In particular, we shall examine the public's evaluation of present technologies, the values which it wishes to see realized in the design and implementation of technological systems, the groups or institutions it wishes to see involved in decision making on questions related to technology, and its reaction to changes in the quality of life wrought by technology. Finally, we shall consider in some depth the correlates of voting behavior on one of the ballot measures which dealt with this type of technological debate -- the Clean Environment Initiative which appeared as Proposition 9 on the June, 1972, California primary ballot.

Evaluations of Presently Implemented, Highly Visible Technologies[16]

A series of questions used in our survey dealt with the perceptions of benefits of several actual technological developments; our findings here will provide a good context -- the atmosphere of acceptance surrounding technology -- for the ensuing discussion. Our respondents were asked to indicate "how much of a change for the better or worse in life in general" each of five different technological developments has made. These five were household appliances, automotive vehicles, automated factories, atomic weapons, and the space program. These were selected as representative of a large range of presently employed technologies that are highly visible, widely implemented and familiar to the public. The data presented in Table 1 shows considerable variance of opinion about these technologies.

TABLE 1

ATTITUDES ON THE SOCIETAL EFFECTS OF FIVE TECHNOLOGIES

	Very Much to Slightly Worse	In Between	Slightly to Very Much Better	N=
Appliances	3.5%	3.4%	93.2%	(974)
Automobiles	15.9	11.4	72.9	(974)
Automation	19.2	17.7	64.2	(969)
Space Program	19.6	19.6	60.8	(966)
Atomic Bomb	45.7	5.4	48.9	(972)

An index developed by aggregating these responses accross the five technologies is likely to reflect reasonably accurately the positive or negative evaluations held about presently employed technology. See Figure 1.

FIGURE 1

TECHNOLOGIES MAKE LIFE BETTER OR WORSE:

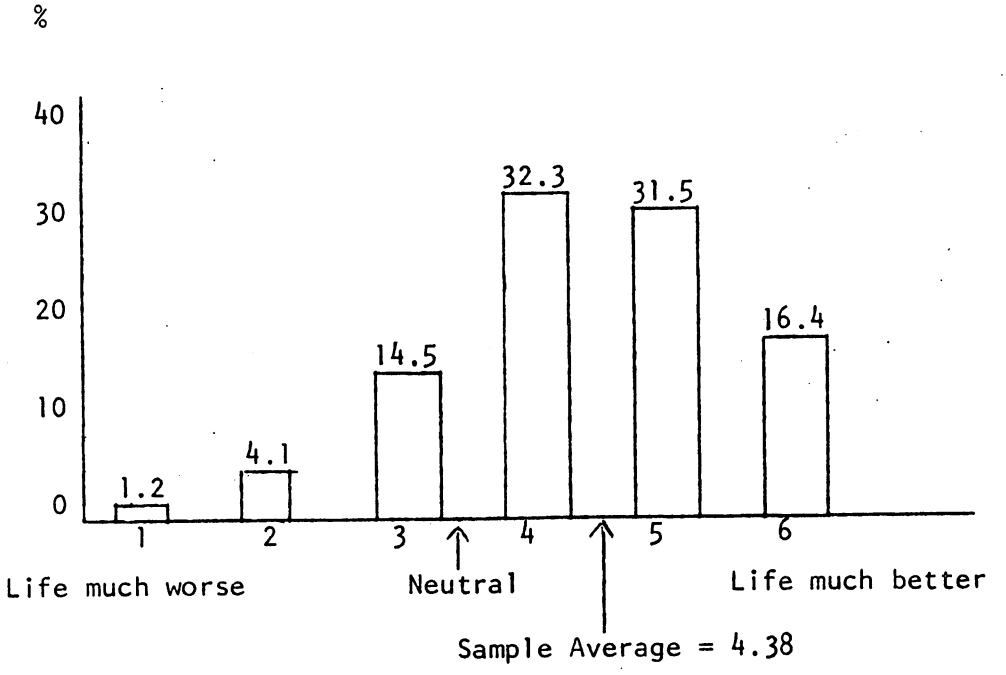

Figure 1 presents the distribution of indexed responses, which is clearly skewed toward the evaluation of technology as making life better. But while the sample is predominantly favorable toward existing technologies, a substantial minority believes them to have eroded the quality of life. When this body of data is analyzed in terms of demographic and political characteristics, some interesting differences emerge suggesting that the democratic vision of technological equity is somewhat dim. While occupation, education, sex, and race do not seem to be associated with differing perceptions of technology's benefits, income does (see Table 2). There are steady and significant differences from high to low income: in general, the higher one's income, the more likely his perception of technology as enhancing the quality of life. Notably, over a quarter of the poor believed otherwise.

TABLE 2

EVALUATIONS OF TECHNOLOGY BY INCOME AND THREE POLITICAL CHARACTERISTICS

	Life Made Worse	Life Made Better	N =
Annual Income			
Under $3000	29.8%	70.2%	(99)
$3000 - 4999	26.1	73.9	(95)
$5000 - 6999	19.3	80.7	(113)
$7000 - 9999	23.4	76.6	(171)
$10,000 - 14999	15.1	84.9	(257)
$15000 - 19999	15.6	84.4	(104)
$20000 +	13.1	86.9	(71)
	Gamma = .206		
Political Ideology			
Strong Conservative	13.9%	86.1%	(98)
Mild Conservative	14.6	85.4	(307)
Middle-of-the-road	24.3	75.7	(156)
Mild Liberal	19.1	80.9	(245)
Strong Liberal	40.4	59.9	(88)
	Gamma = -.252		
Party Identification			
Democratic	24.4%	75.6%	(522)
Republican	10.2	89.8	(305)
	Gamma = -.477		
Candidate Choice in Democratic Primary			
McGovern	30.8%	69.2%	(170)
Wallace	18.4	81.6	(22)
Humphrey	12.1	87.9	(103)

$x^2 = 13.01$ df = 2

$p < 0.001$

Political orientation seems to make a difference also. Table 2 suggests that there is a minority of strongly liberal citizens -- likely to be Democrats and to have voted for McGovern in the California primary -- who question the overall benefit of these technological developments. Although the data does indicate that the population as a whole gives these technologies high marks for improving the quality of life, the number of dissenters nevertheless is surprising in a society which has been so very dependent upon technological developments for its growth and power. It seems apparent that the poor and the politically liberal have not yet coalesced around technology as a political issue; however, the data thus far suggests that some of the conditions which have classically been the grounding for political controversy are present here. There are glimmerings of evidence that one's experience of technology's gifts depends upon one's social class and, apparently, that those with opposed political beliefs also evaluate a bit differently the contributions of technology. We can learn more about why some sectors of the general public support present technologies and others oppose them by turning to the question of values.

Criteria for Technological Choice: What They Are and Who Chooses Them

The design and implementation of any large-scale technological system involves tradeoffs among values. Many times these tradeoffs revolve around values associated with the primary capacity of the new system. Traditionally, questions of cost versus quality or of cost versus optional features most often presented themselves. Recently, the range of priorities has been extended to include values affected by second-order consequences. The problem in automotive systems of economy versus degree of environmental protection is an excellent case in point. The centrality of this kind of issue at the present time is well illustrated by a nationwide advertisement for the Chrysler Corporation which aptly states one side of the case: "Reducing emissions by these last few percentage points...is like trying to squeeze the last few drops of juice out of an orange. You get to the point where the results are no longer worth the effort. We're coming to that with emissions controls."[17]

With this increasingly important aspect in mind -- value tradeoffs in the planning and implementation of technology -- we asked those sampled to consider seven social values which might be affected by the design of a new technology. We asked them to assign some "absolute" degree of importance to each. Then, prefacing the subsequent question with the reminder that often decisions have to be made in which one value predominates at the expense of others -- "Often it is impossible to give equal importance to all...factors" -- we asked respondents what rank they would assign to each of the values in relationship to the others listed. As can be seen from the data presented in Table 3, four out of the seven criteria for technological assessment were perceived to be "extremely important" by at least a majority of the sample.

TABLE 3

ABSOLUTE AND RELATIVE IMPORTANCE OF CRITERIA IN TECHNOLOGICAL CHOICE

Criteria	Extremely[a] Important	Mean Ranking
Effect on Employment	60.6%	3.00
Effect on Pollution	72.3	3.16
Makes Life Enjoyable	47.0	3.33
Effect on Taxes	56.3	3.71
Effect on Poor People	59.7	3.76
Effect on U.S. Prestige	32.8	5.05
Effect on Leisure Time	17.8	5.96

[a] Rest of distribution does not distort the meaning of these figures.

But the mere expression of preferences by the public has rarely been sufficient for them to become incorporated into new technological systems. In this domain, several groups and institutions hold decisive power. To discern the public's perceptions about how this power is being exercised, we asked our sample which of eight groups of actors they see as having the most (and the least) say in how decisions are made in each of six areas of technology. In addition, we asked them which of these actors should, in their opinion, have the most (and the least) influence.[18] The results have appeared elsewhere in detail;[19] here we shall only summarize them:

(1) People perceive a high degree of centralization of decision making power concentrated in top governmental leaders, that is, in the members of the Executive Branch. There is a definite uneasiness about this concentration, and it is reflected in the fact that that group falls from first in the descriptive ranking to fourth in the normative listing.

(2) The biggest "loser" in the public's mind is the business establishment, which is perceived as being quite influential in the decision making process. Normatively, however, there is strong opposition to its role. Business leaders fall from third place in the former ranking to eight place in the latter.

(3) Technical experts rate highly in the mind of the general population. They are perceived as exercising, legitimately, a large degree of power in the control of decisions on technological matters.

(4) The major disjuncture between those perceived as actually having influence and those seen as legitimately deserving to have it occurs in the case of the public's role in deciding how technologies should be implemented. In each of the six decision domains, the public is felt to have the least amount of say in controlling technology. Yet, at the same time, that group is ranked first in normative terms.

These findings can be better understood by considering what we mean by a "decision." Following Herbert Simon, we can break the term up into two components, one based on factual premises, the other on valuational premises.[20] Thus, the technologist is perceived as having legitimate power because he is an expert in understanding the factual premises of a technological decision. Governmental and business leaders can only

legitimate their control of technological decision making in terms of valuational premises; that is, they can rightfully only set goals and establish preferences over outcomes.

Yet, the data suggests, in the strongest possible terms, that the public is highly unsatisfied with the influence exercised by both business and government. This dissatisfaction must be seen as deriving from disagreement with or distrust of the valuational premises used by both those groups. Our sample is clearly stating that the public collectively or the individual himself must be provided greater access to the decision making processes related to technological development -- perhaps through mediating institutions such as public interest organizations like the Sierra Club and advocates like Ralph Nader -- in order to make their value preferences felt.

If such an interpretation is correct, we would expect to find a negative association between the degree of disjuncture -- as measured by the difference between the normative and prescriptive rankings -- and evaluations of present technologies in the case of business and governmental leaders. Moreover, we would not expect to find <u>any</u> association in the case of technical experts. The cross-tabulation of the disjuncture variables with our measure of support for existing technologies appears in Table 4:

TABLE 4

PERCENTAGE OF RESPONDENTS THINKING THAT PRESENTLY IMPLEMENTED TECHNOLOGIES HAVE MADE LIFE WORSE BY DEGREE OF DISJUNCTURE FOR VARIOUS DECISION MAKERS

	Degree of Disjuncture				
Actor	Low	Medium	High	N =	Gamma
Technical Experts	18.3%	21.2%	19.1%	(975)	-.002
Business Leaders	16.0	33.6	38.0	(966)	-.190
Governmental Leaders	14.2	20.2	31.7	(963)	-.200

These findings tend to confirm our interpretation of this portion of the data. There is a definite increase in the percentage of people giving low evaluations to technology as their degree of disjuncture increases for the cases of business and governmental leaders. This monotonic change is not observed in the case of the technical expert, where differences in the proportion are very likely attributable to sampling errors.

The patterns of relationship apparent in Table 4 strongly suggest that evaluations of technology are connected with disagreements over the values it nurtures. Up to this point in our survey, however, we had not yet considered whether these are conflicts over primary or secondary values. To investigate this question, we considered -- and incorporated into our instrument -- some of the more "radical" propositions of thinkers who criticize technology on the very grounds of defective value priorities. Throughout their writings we find continual reference to the "fact" that without regulation technology will run rampant and go out of control, that life has been made too complicated by technology, that people have become too dependent on machines, and that we need to reclaim the virtues of the "natural life" from which technology has alienated us. We asked our respondents whether they agreed or disagreed with the following statements:

> "Unless there is some regulation of which inventions are widely produced or made available, our way of life will become worse."
>
> "Technology has made life too complicated."
>
> "People have become too dependent on machines."
>
> "It would be nice if we could stop building so many machines and go back to nature.

The frequency distribution of responses to those statements appears in Table 5.

TABLE 5

EXTENT OF AGREEMENT WITH "RADICAL CRITIQUE" OF TECHNOLOGY

Critique	Degree of Agreement: Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree	N =
Must regulate inventions	18.8%	32.4%	12.2%	24.7%	11.9%	(923)
Life is too complicated	23.3	31.4	8.7	26.4	10.1	(947)
Depend too much on machines	7.5	13.3	6.3	33.5	39.4	(959)
Go back to nature	31.8	25.0	10.2	21.1	11.9	(948)

Somewhat surprisingly, it would seem that the so-called radical critiques of technology find strong resonance in the public as a whole. While only one of these is endorsed by a clear majority of the population, they all find substantial support among our sample. And while such expressions can hardly be construed as a serious measure of intent, the very fact that many respondents were moved to voice such sentiments is in itself a kind of indictment of the post-industrial pace.

If our suspicions about the nature of technological controversies are correct, we would expect to find an association between people's evaluation of the merits of technology and their sense of its negative second-order consequences. Table 6 presents figures on that association.

TABLE 6

PERCENTAGE OF RESPONDENTS THINKING THAT PRESENT TECHNOLOGIES HAVE MADE LIFE WORSE BY DEGREE OF AGREEMENT ON THE EXISTENCE OF SEVERAL NEGATIVE 2ND-ORDER CONSEQUENCES

Critique	Degree of Agreement: Strongly disagree	Moderately disagree	Moderately agree	Strongly agree	N =	Gamma
Must regulate inventions	31.2%	24.1%	16.9%	13.4%	(811)	-.195
Life is too complicated	43.7	26.3	13.5	13.6	(864)	-.284
Depend too much on machines	28.2	17.5	12.4	8.9	(899)	-.197
Go back to nature	42.8	26.5	15.8	10.9	(852)	-.367

Note: The neutral category is not reported, as it may be unduly contaminated by those who cannot give a meaningful answer.

Our findings here appear to support our hypothesis: the expected associations are present between disaffection with technology and a belief in its negative second-order consequences.

We can recapitulate the basic propositions which have been sustained by evidence presented in our consideration of the criteria guiding technological choice. First, the range of values which the public finds "extremely important" in assessing technologies is much broader than many technical systems aim to incorporate: it goes far beyond considerations of cost, quality, efficiency, or optional features to include values affected by technology's second-order consequences -- values such as a clean environment, the condition of the poor, and the quality of individual life. Interestingly, the frequently offered arguments for accelerated technological development such as a prestigious U. S. image and increased leisure time failed to find much confirmation among our sample. Second, there exists a substantial conviction that the groups which determine and control the values which are to be taken into consideration in decisions involving the implementation of a technology are not properly sensitive

to public preferences. This disagreement over values is linked with people's negative evaluations of technology. Third, the locus of disagreement appears to be, at least partially, in the domain of the values seen as being adversely affected by technology's second-order consequences.

It remains for us to question the way in which these conflicts over values touched by technology have entered the political arena. We will try to find some answers by examining our sample's voting behavior as related to the Clean Environment Initiative.

The Clean Environment Initiative: A Case of Conflict over Technology

It seems entirely appropriate that one of the legacies of the Progressive Era's attempts to place the trusts under popular control, the initiative process, should have been the means whereby California citizens tried to control the consequences of corporate technology. Under the leadership of the People's Lobby, petitions were circulated throughout California drawing 339,000 valid signitures, so that by June, 1971, the "Clean Environment Act" (Proposition 9) qualified for a place on the coming year's ballot. The measure contained five major sections dealing with a number of the sources of environmental concern. Among its many provisions were the following:

(1) Composition of Motor Fuels: The Act specified that five days after passage, the sulfur content in diesel fuel had to be reduced by nearly 90%; it also called for a more rapid elimination of lead from gasoline than required by Federal law and a total ban on lead by January 1, 1976.

(2) Stationary Sources of Pollution: The Act required industries operating under variances to shut down during smog alerts; these industries would also have to install emission control devices within a specified time. Violations were to be penalized by fines authorized at the rate of 0.4% of a violator's gross income per day from the time of conviction to the time of compliance, in order to discourage repeated violations. Seventy five percent of the fine would be returned upon completion of the installation program.

(3) Pesticides: The Act outlawed the use of all persistent chlorinated hydrocarbons such as DDT.

(4) Nuclear Power Plants: The Act prohibited the construction of nuclear reactors for five years.

(5) Developments in the Petroleum Industry: The Act banned new off-shore and coastal drilling, prevented the renewal of old leases, and required that under hazardous conditions those sites already in production cease operating until dangers had been removed.

The Clean Environment Act also sought to eliminate conflict of interest among those appointed to the State Air Resources Board, county Air Pollution Control Districts, regional and state water boards, and among those enforcing agricultural regulations. It prohibited the State Legislature from repealing or weakening its provisions. Finally, the proposed law permitted class actions and injunctions to be issued against polluters.

While the full story of the campaign for and against Proposition 9 cannot be detailed here, we shall try to highlight some of its more salient aspects. The contest really came to the surface one month before the election, during May, 1972, when opponents of the measure, using the public relations firm of Whitaker and Baxter and backed by a fund of over $1.5 million collected from California's many oil firms, banks, heavy industries and utilities, unleashed an extensive media campaign. Labor leaders, Republican and Democratic politicians, and chambers of commerce were all enlisted into the fight against the measure. While many environmental organizations, such as the Friends of the Earth, came out in support of the proposition, the highly influential Sierra Club took a neutral position, which was widely interpreted as tacit opposition.

Newspaper and television editorials were unanimously against the measure. The Los Angeles Times, with the largest circulation in the state, commented that "[The Initiative] is being touted as a comprehensive assault on pollution. It is in fact a slapdash and deceptive measure which, if enacted, would probably increase air pollution, disrupt control procedures, and cost the people of California untold millions in unnecessary expense and penalties."[21] The San Francisco Chronicle, the Bay Area's

major newspaper, concurred: "The Environmental Initiative...has been judged in appraisals as a prime example of overkill....Preservation of a clean environment is indisputably laudable but in posing as its champion, Proposition 9 is dangerously misleading."[22]

Proponents of the measure were, from the start, on the defensive. They were handicapped in responding to the attacks by lack of funds for a media campaign. Moreover, their supply of volunteer activists was heavily cut into by McGovern's efforts in California before the Primary. But probably more importantly, they were handicapped by the Proposition itself. Many of its own supporters were disturbed by the legal ambiguities written into the Act. The full consequences of many of its provisions did not appear to be well thought out. Little consideration was given to how enough low sulfur diesel fuel could be obtained to operate California's trucks, buses, and trains. The simultaneous restriction on fossil fuel production and atomic reactors seemed contradictory at best and perhaps potentially disastrous in the face of an ever growing energy shortage. By the end of the campaign, the proponents' arguments centered more and more on the "symbolic necessity" of passage.[23]

The opposition, of course, exploited this embarrassment on the part of the measure's supporters. But its central point was that the values of technology's primary capacity far outweigh any damage to other values brought about by its second - order consequences, in this case environmental disturbances. A memorandum from Whitaker and Baxter to the Standard Oil Company, obtained by the People's Lobby and never repudiated by either firm, set out the opposition's strategy a year before the election: "This truly is an issue the people must decide and it must truly be a people's campaign to determine how much people are willing to endure in the loss of jobs, higher prices, and less of the niceties of life to enhance the environment. Obviously, there must be a balance between a pastoral society and an industrialized service society."[24] The effect of such a strategy would naturally be virtually to obscure the question of environmental protection. More and more the questions

became, "Do you want to cause massive unemployment?" Do you want to run out of power for your dishwasher or washing machine?" Do you want an epidemic of malaria or yellow fever to descend, plague-like, upon California?" Do you want the growth of California's economy to be halted?"

The effectiveness of the opposition's campaign was truly phenomenal. As of the first of May, only 27% of those sampled by the Field Research Corporation's California Poll had even heard of the Proposition. At that time, nearly sixty percent of those who had heard of it expressed support for the measure, and another ten percent was undecided. When informed by the Field interviewer of the contents of the Initiative, those who had not heard of it came out in favor of it by a margin of greater than three to one. Combined, these groups numbered 64.2% in favor, 21.5% opposed, and 14.3% undecided.

Four weeks later, the proportion of the population familiar with the measure had risen three-fold to 88%. Of those who had made up their minds about it (approximately one-half of the total), feelings were running nearly two to one against the proposal. While those who had not decided or who had not heard of the Initiative tended to look on it somewhat favorably, a projection of the total vote was made as follows: In favor: 35%; Opposed: 47%; Undecided: 18%.[25] The final vote actually turned out to be 35.2% in favor and 64.8% opposed.

While it is undeniable that the rather haphazard construction of the measure contributed to its defeat, it seems clear from the way the campaign developed that a major influence was the marshalling of the people's unwillingness to sacrifice the values of technology's primary capacity in return for preserving values adversely affected by its second-order consequences: In particular, we will present evidence that the opposition's strategy was eminently successful in forcing people to make that value choice and that as they chose so did they vote.

The Vote on Proposition 9: A Plebiscite on Technology

Before we can investigate the correlates of the vote itself, it is instructive to consider in greater detail the climate of opinion on the measure at the time when the public first really became aware of the issue. To do this, we shall examine data from the California Poll taken during the first part of May, 1972. As we just mentioned, that study indicated a strong margin of support for the Initiative.

That support was not a function of any particular demographic or political attributes. Thus, if we were to cross-tabulate the respondent's intended vote with his geographic location, occupation, religion, race, sex, income, or education, we would not find any statistical association. Similarly, political variables, with one exception, turn out to be equally unsatisfactory predictors of his intended vote. A person's party, his choice of candidate in the Democratic primary, his attitude about what should be done in Vietnam, his position on the legalization of marijuana, or his choice from among the various Democratic hopefuls running in trial heats against Nixon all show no statistical relationship. The one exception just referred to is a person's self-proclaimed political ideology, which does seem to set off, albeit rather weakly, those inclined to support the measure from those tending to oppose it. The overall lack of association between the intended vote and this wide range of political and demographic variables was observed when the entire sample was examined, when only those who had heard of the measure were included, when only those who intended to vote in the primary election were taken into consideration, and when only those who had heard of the Proposition and intended to vote in the primary were included.

Table 7 illustrates the heterogeneous nature of the support given the Clean Environment Initiative by the entire sample in early May.

TABLE 7

INTENDED VOTE IN MAY BY VARIOUS DEMOGRAPHIC AND POLITICAL VARIABLES

	Definitely Yes	Probably Yes	Probably No	Definitely No	Undec.	N =
Age						
18 - 24	50.0%	29.6%	7.4%	5.5%	7.5%	(162)
25 - 39	40.5	24.9	10.5	10.3	13.8	(361)
40 - 55	30.6	28.1	11.9	12.9	16.5	(309)
56 +	35.6	24.4	11.2	12.2	17.4	(289)
			Gamma = .023			
Party Identification						
Republican	34.5%	23.2%	12.9%	13.2%	16.1%	(310)
Democratic	38.7	26.8	10.7	10.1	12.7	(466)
			Gamma = .061			
1st Choice as Democratic Presidential Nominee						
McGovern	46.4%	28.2%	9.1%	7.5%	9.1%	(110)
Humphrey	34.6	24.0	12.5	11.5	17.5	(104)
Kennedy	37.0	28.7	8.3	12.0	13.9	(108)
Muskie	55.9	26.5	2.9	5.9	8.8	(34)
Wallace	50.0	10.7	14.3	14.3	10.7	(28)
			$X^2 = 54$ df = 44			
			$p > .20$			
Political Ideology (Self-Identified)						
Strong Conservative	32.3%	17.2%	14.0%	23.7%	12.9	(93)
Moderately Conservative	35.7	24.5	13.9	12.3	13.6	(359)
Middle-of-the-road	41.0	24.5	8.7	8.7	17.0	(229)
Moderately Liberal	41.7	33.0	9.6	8.7	7.0	(230)
Strong Conservative	55.7	31.8	3.4	3.4	5.7	(88)
			Gamma = -.213			

It is not surprising that support for this measure designed to protect the environment cut through virtually all segments of the population. For by this point in time, every politician from President Nixon and Governor Reagan to Senators Tunney and Cranston to Mayors Alioto and Yorty had made strong statements against pollution and for the preservation of our natural resources. To be anti-conservation was, like being against motherhood or applie pie, un-American. The question is, and has always been, what are people willing to pay for a clean environment. In May, 1972, an overwhelming majority of those who had heard of the Initiative and those who were presented with the proposition as it would appear on the ballot by the California Poll interviewers appeared willing to pay the price it would levy. A month later, having been bombarded by increasing quantities of information/propaganda, the public went to the polls and overwhelmingly defeated the Clean Environment Act. Let us now examine public attitudes at the very time of the election to get some clue as to the reasons behind that massive reversal.

As part of our study of public attitudes about technology, we asked the June sample how they had voted on the Environmental Initiative. Not only did this survey pick up the remarkable shift in opinion, but it also, on analysis, revealed some interesting sets of associations. In particular, whereas in May age, party identification, candidate choice in the Democratic Presidential Primary Election, and political ideology were at best only marginal predictors of an individual's intended vote on Proposition 9, by June these variables configured definite patterns.[26] These are presented in Table 8.

TABLE 8

VOTE ON PROPOSITION 9 IN JUNE BY SELECTED DEMOGRAPHIC/POLITICAL VARIABLES

	Voted For	Voted Against	N =
Age			
18 - 24	63.4%	36.6%	(41)
25 - 39	56.5	43.5	(141)
40 - 55	44.7	55.3	(136)
56 +	25.5	74.5	(126)
	Gamma = -.403		
Party Identification			
Republican	28.3%	52.3%	(149)
Democratic	71.7	47.7	(259)
	Gamma = -.471		
Candidate Voted For in Democratic Primary			
McGovern	66.1%	33.9%	(132)
Wallace	48.0	52.0	(20)
Humphrey	35.4	64.6	(74)
	$X^2 = 18.5$ df = 2		
	$p < 0.001$		
Political Ideology (Self-Identified			
Strong conservative	36.8%	63.2%	(52)
Moderately conservative	35.0	65.0	(150)
Middle-of-the-road	36.4	64.6	(67)
Moderately liberal	50.7	49.3	(112)
Strong liberal	85.0	15.0	(49)
	Gamma = -.363		

Thus, in a month's time, sharp partisan differences emerged, as did intra-Democratic party cleavages. The partitions along liberal/conservative lines and young/old lines became intensified. Are these newly emerged differences only spuriously associated or are they causally connected? How can we fit them into the general theoretical framework which we have been considering thus far, that of the conflict between values advanced by technology's primary capacity and those adversely affected by its second-order consequences?

To get some ideas about those questions, let us return to the data collected. We asked each respondent what his reason had been for voting as he had. Table 9 presents those reasons.

TABLE 9

REASONS FOR VOTING FOR OR AGAINST THE ENVIRONMENTAL INITIATIVE

Reasons for Support	
1. Did not like advertising/big business was against it	13.1%
2. Need to clean up air/reduce air pollution	18.4
3. Clean up environment (other than air)	19.5
4. Have to stop pollution (general)	28.4
5. Need to control business/make them pay for pollution	11.7
6. Need to do something/start somewhere	17.6
7. Liked its stand on nuclear power plants	7.6
8. Good idea/good for the people	7.3
Reasons for Opposition	
1. Advertising against it/business, labor, radio, TV against	12.1%
2. Too restrictive	7.1
3. Drastic/strong	8.6
4. Unrealistic, impractical	9.2
5. Poorly written/not well thought out	25.4
6. Raise unemployment	8.9
7. Disliked stand on nuclear power/need power	24.3
8. Too extensive	21.2
9. Would not solve problems	12.5
10. Need pesticides for food production	3.3

(Note: Percentages sum to more than 100% due to some instances of multiple response.)

If nothing else, this data stands as strong testimony to the public's ability to at least rationalize its voting behavior on a relatively complex issue in terms of the information/propaganda received from the various media. The judgments compiled in Table 9 reiterate the claims made by opposing spokesmen during the campaign. Clearly, those who voted in favor of the Initiative did so because they did not want to allow something highly valued, a well-preserved environment, to be adversely affected as a consequence of continued implementation of widespread technological systems. Similarly, those who opposed the measure (with perhaps the exception of those who felt uneasy about its ambiguous and confusing language) justified their opposition in terms of the importance of allowing the values furthered by the primary capacity of technology to continue with only moderate, at best, regulation imposed on it.

But these figures hide as much as they reveal. For a cursory examination of them suggests simply that those who were strongly environmentally conscious supported the Act while those who were not did not. But such an interpretation finds only a limited amount of support when the data is examined in greater detail. There appears to be, in fact, a more generalized association between the vote on Proposition 9 and the belief that technology negatively affects cherished values -- the environment being only one of them.

As a measure of importance given to protecting the environment, we used the ranking that that particular value received in tradeoffs with other values (see Table 3). As expected, some association was observed between that ranking and the vote on Proposition 9. Yet, it is not nearly so pronounced as a superficial interpretation of the data would presume. The ranking accounts for only four percent of the variation in the vote. One explanation of this weak association lies in the context in which the campaign was waged. The opposition claimed that the measure would not only be ineffective but would actually <u>increase</u> air pollution by prohibiting the construction of nuclear power plants which do not pollute the atmosphere.

(The problems of increased radiation leakage and the thermal pollution of waters surrounding reactors were conveniently ignored.) Thus, it seems reasonable that this blurring of the pollution issue during the campaign acted to reduce the strength of the relationship. Table 10 presents the data.

TABLE 10

VOTE ON PROPOSITION 9 BY RANKING OF THE VALUE " ENVIRONMENTAL PROTECTION"

Ranking	In Favor	Against	N =
Low	26.8%	73.2%	(57)
Med.	39.6	60.4	(192)
High	56.6	43.4	(181)

Gamma= .368

If our notion is correct that the vote on the Clean Environment Initiative is a function of a more generalized conflict over values involved in the implementation of technology, we would expect to find relationships between the vote and other variables such as those considered above as "criteria for technological choice." Further, we would have to demonstrate that the strengths of association are comparable, if not greater than the one with the variable measuring the importance given by respondents to protecting the environment. Let us see what such investigation reveals.

The Initiative directly dealt with two highly visible technological systems -- automobiles and atomic power plants. We sought to measure the extent to which our sample's support for these technologies was related to their vote on Proposition 9. While negative attitudes may stem from feelings that these systems are

deleterious to the environment, such opinions may also derive from feelings that automobiles and highways disrupt communities or that power plants may explode or leak radiation. Thus, it is likely that evaluations of these technological systems reflect a wide range of values which are seen as being affected by both the primary and secondary consequences of technological implementation. Such an interpretation of the data is supported only in the case of nuclear reactors, as the correlations between that variable and the vote remain essentially constant when the respondent's ranking of the importance of environmental protection is controlled for. In the case of automobiles, however, controlling for environmental concerns reduces the association almost to zero -- thereby suggesting a spurious relationship. That, in turn, would suggest that the public's attitudes toward automobiles which determined, to some degree, its vote on Proposition 9 stemmed mainly from the automotive technology's second-order effects on the environment. Tables 11 and 12 illustrate the first-order relationships between the measures of evaluation and the vote on the Clean Environment Initiative.

TABLE 11

VOTE ON PROPOSITION 9 BY EVALUATION OF NUCLEAR POWER PLANTS

Evaluation	In Favor	Against	N =
High	71.1%	28.9%	(28)
Med.	49.3	50.7	(64)
Low	31.2	68.8	(108)

Gamma = .469

TABLE 12

VOTE ON PROPOSITION 9 BY EVALUATION OF AUTOMOBILES

Evaluation	In Favor	Against	N =
High	63.7%	36.3%	(34)
Med.	45.0	55.0	(178)
Low	41.6	58.4	(230)

Gamma = .160

A major area of contention during the campaign was the claim that the passage of the Initiative would bring massive unemployment and a screeching halt to economic growth. Implicit in this claim was the belief that continued unimpeded implementation of the primary capacity of technology is a crucial prerequisite for improved standard of living. We would expect that those who believed this would be relatively disinclined to forego the advantages enhanced by that capacity in favor of values negatively affected by second-order consequences. Table 13 presents the data pertaining to that hypothesis.

TABLE 13
VOTE ON PROPOSITION 9 BY BELIEF THAT TECHNOLOGY IS NECESSARY FOR INCREASED STANDARD OF LIVING

Degree of Agreement	In Favor	Against	N =
Strongly disagree	52.9%	47.1%	(55)
Moderately disagree	52.0	48.0	(97)
Moderately agree	47.1	52.9	(114)
Strongly agree	31.9	68.1	(148)

Gamma = .261

Note: The neutral category is not reported, as it may be unduly contaminated by those who cannot give a meaningful answer.

The supporters of the Proposition tried to portray the business establishment as a group of evil minded men bent only on increasing their profits and maintaining a public-be-damned attitude. But the Whitaker and Baxter agency had anticipated such an argument and sought to convey the impression that labor leaders, academicians, professionals, and politicians from both parties were united in their opposition to the measure. This strategy tended to prevent the issue from being "cast in the light of a great environmental test between the people and the business and industrial 'despoilers' of our land."[27] Yet, it seems clear that many people perceived that an indirect

consequence of continued relatively unrestricted implementation of technology would be the continued increase in power and wealth of business leaders which would perpetuate their "illegitimate" involvement in setting the values to be achieved through technological development. Thus, we would expect to find that those who were most likely to perceive a great disjuncture between descriptive and normative rankings of the influence of business leaders would be most likely to vote in favor of Proposition 9. Conversely, following the arguments made previously, we would not, in the case of technical experts, expect any relationship to obtain between that measure of disjuncture and the vote. Tables 14 and 15 contain the data which relates to those inferences.

TABLE 14

VOTE ON PROPOSITION 9 BY DEGREE OF DISJUNCTURE IN THE DECISION MAKING ROLE OF BUSINESSMEN

Degree of Disjuncture		In Favor	Against	N =
Low	1	32.3%	67.7%	(165)
	2	37.1	62.9	(88)
	3	47.3	52.7	(64)
	4	65.4	34.7	(43)
High	5	64.8	35.2	(83)

Gamma = -.375

TABLE 15

VOTE ON PROPOSITION 9 BY DEGREE OF DISJUNCTURE IN THE DECISION MAKING ROLE OF TECHNICAL EXPERTS

Degree of Disjuncture		In Favor	Against	N =
Low	1	40.0%	60.0	(140)
	2	45.1	54.9	(105)
	3	49.0	51.0	(84)
	4	49.5	50.5	(67)
High	5	43.7	56.3	(47)

Gamma = -.085

Other variables measure more directly the desire to preserve values adversely affected by the second-order consequences of technology. In particular, attitudes about dependence on machines, the impulse to return to a more natural state, and the extent to which life is viewed as being made too complicated by technology all address that very point. An index was made up from those three variables. It can be understood as representing a measure of the belief in the existence of social dislocations and anxieties which derive from second-order consequences of technology. Its relationship to the vote on Proposition 9 is given in Table 16:

TABLE 16

VOTE ON PROPOSITION 9 BY AGREEMENT ON SECOND-ORDER NEGATIVE SOCIAL CONSEQUENCES OF TECHNOLOGY

Degree of Agreement	In Favor	Against	N =
Low	33.0%	67.0%	(195)
Med.	50.7	49.3	(176)
High	61.6	38.4	(72)

Gamma = -.369

A person's voting behavior with respect to the Environmental Initiative, therefore, may be construed as a function of a wide range of attitudes about the consequences of technological development. Such a claim finds support in the results of a linear regression performed using the vote on Proposition 9 as the dependent variable. Standardized regression coefficients (beta weights) were estimated for each variable. These coefficients are a measure of the causal influence which the variable exerts on the vote with the effects of all the other variables controlled for. Moreover, the use of these estimates avoids the problem of spuriousness inherent in measures of association. Thus, the estimate will not be significantly different from zero if there is no effect or if any relationship is a spurious one. Table 17 gives these estimates in order of magnitude.

TABLE 17

ESTIMATES OF STANDARDIZED COEFFICIENTS FOR SELECTED VARIABLES REGRESSED ON PROPOSITION 9 VOTE

1. Evaluation of nuclear power plants	0.19
2. Degree of disjuncture in decision making role of businessmen	0.17
3. Importance of protecting the environment	0.17
4. Negative second-order social consequences of technology	0.11
5. Partisan identification	0.11
6. Standard of living dependent on technology	[not significantly different from zero at p=0.5]
7. Age	[not significantly different from zero at p=0.5]
8. Evaluation of automobiles	[not significantly different from zero at p=0.5]
9. Self-proclaimed ideology	[not significantly different from zero at p=0.5]

It would seem then, because attitudes toward a wider range of second-order impacts than simply feelings about protecting the environment had roughly comparable independent influences in determining the vote, that Proposition 9 became a surrogate plebiscite on technology.

The Character of Controversy over Second-Order Consequences of Technology

These findings raise as many questions as they answer. Why have environmental issues enjoyed such a favored position in political controversies involving technology? Why haven't other "negative externalities" -- occupational and social disturbances, threats to privacy and to the political significance of the individual, and social and psychological malaise -- emerged as focal points of conflict. Why, in fact, do those other issues appear to be contested only indirectly? While we can do little more than speculate on those questions, we strongly suspect that Ellul's conceptualization of the problem offers some hints to the answer.

Recall that Ellul spoke of "technological anaesthesia" which generates acceptance of technological innovations with little or no regard to the particular impacts which may occur as their indirect consequences. Automobiles, for example, are used in the center of cities like New York and San Francisco even though they contribute negatively to mobility and positively to pollution, congestion, noise and personal discomfort. Suggestions to limit the usage of this technological system by cutting back on highway construction or through the rationing of gasoline have only met with either derision or outrage. Similarly, the use of sophisticated electronic equipment in police investigations continues despite the fact that Constitutional restrictions prohibit the admittance into the courtroom of information so obtained. Yet, as we suggested above, the commitment to the primary capacity of technology has not been so complete that there have been no instances in which a technology was modified to preserve secondary values. The decision to forego the development of the SST, the regulations requiring a reduction on the noxious emission of internal combustion engines, the ban on DDT as a pesticide, and the new rules governing the dumping of effluents into public waters all testify to the potential of technological reversibility.

What, then, distinguishes those technological systems which are reversible on account of their negative second-order effects from those which are not? To note that the former all seem to involve questions of environmental protection is useful but

hardly gets us beyond the point made throughout the last portion of this paper: that is, it is not surprising that modifications have been made in technological systems because of environmental demands, as this issue commands a high degree of political legitimacy. Perhaps, then, we ought to consider why ecological demands are such a potent means of altering the implementation of technological systems.

Certainly the fashionable nature of the issue has contributed to its political clout. Moreover, conservation of the environment is widely considered an important value. Yet, these two factors do not appear to be sufficient to distinguish those values which serve to reverse or alter the manner in which the primary capacity is implemented from those which do not. Clearly, many non-ecological second-order consequences of technology, such as increased alienation, have become important issues among the radical chic as well as many opinion leaders and intellectuals. In addition, the data noted above (see Table 5) strongly suggests that a significant portion of the population agrees that continued technological development is endangering other values besides environmental ones.

We would argue that the necessary condition for success in any attempt to change the course of technological implementation on the basis of a tradeoff between values adversely affected by second-order consequences and those advanced by the primary capacity is the degree to which the second-order impacts can be causally linked to the primary capacity. The SST was abandoned because its opponents could document the problems of noise and the disruption of the nitrogen oxide layer. The use of DDT was banned because it could be proved that the chemical entered into the food cycle of numerous animals. That the pesticide appeared in significant concentrations in mothers' milk certainly counted heavily in that conflict. Similarly, the emissions of automobile exhaust were shown to be the prime constituent of smog. The pollutants in the Hudson River, the Potomac River, and in the Great Lakes which virtually destroyed all living organisms in those waters could be traced directly to the effluents from industrial plants in the vicinity.

Once the cause/effect relationships which link adverse indirect effects of technology to their primary capacity are known, traditional pluralist bargaining procedures generally take over. Certainly this is precisely what we have been witnessing in the case of the ecology movement. The recognition that technological systems may damage our natural environment -- so eloquently stated by the work of such people as Rachel Carson -- has led to the formation of groups such as the Sierra Club and the Friends of the Earth which lobby and attempt to articulate interests in much the same way as the Farm Bureau and the AFL-CIO. The alternations in technological systems referred to above stand as testimony to the efficacy of their efforts.

Yet, we would argue that under the pluralistic bargaining framework positions taken in favor of preserving other values adversely affected by the primary capacity are highly discounted because very little knowledge exists by which rival claims can be judiciously assessed. Under such conditions, the pluralist debate becomes little more that a charade, despite the fact that agreement on those values felt to be at stake is often widespread.

We are thus forced to design and implement widely spread technologies in the face of incomplete knowledge of their consequences. We do not know, for example, how to link up the introduction of something like cable TV with its possible effects on socialization, community organization, or the entertainment industry. We cannot adequately assess what would happen to the economy, to the right of privacy, or to the Government's ability to plan if a national data bank were instituted. Because of this inability to account for second-order impacts, it is likely that decisions on these, as well as other, technologies, will be made almost exclusively on the basis of the values accruing from their primary consequences. It is only the rational thing to do! Thus, Ellul's vision of the future appears to depend more on man's collective lack of knowledge than on any inherent characteristics of technology.

Such "rational" choice in the implementation of new technological systems may very well be dysfunctional for the social system in the long run, as it does not allow generalized feelings of frustration about technology's unknowns to be dealt

with. As we have seen, there is ample evidence that such feelings are present in the general population now. It is not hard to hypothesize that they will increase if value tradeoffs continue to be rather one-sided. In the extreme case, the defense of values adversely affected by secondary impacts is completely ignored in favor of the values advanced by the primary capacities. Then one could expect a large amount of polarization as well as major conflicts which have little hope of resolution because of disagreement on both factual and valuational premises. In such a circumstance, either the leader who damns the artificiality of the machines and urges us back to nature or the one who glorifies man's progress through technology may exert overwhelming influence.

Several factors may exist, however, which would serve to mitigate such tensions. The emergence of such issues as the Clean Environment Initiative acts as a surrogate to allow more generalized anti-technology attitudes to be considered in the political arena, and we can expect this kind of issue to become more frequent in the future. For Proposition 9 clearly represents what J. David Greenstone has termed a "consumer issue." He argues quite persuasively that "since so many groups in America have accepted a rapid rate of change, debate over the policy outputs of the political system has become increasingly concerned with the <u>impact of instrumental rationalization</u> on the quality of life....It is by no means clear that contemporary consumer-producer class politics will prove any less important than proletarian-bourgeois conflict a century ago."[28]

But the simple emergence of the issue is a necessary but not sufficient condition. It does not guarantee that the conflict will be settled in a way which reduces tensions rather than exacerbates them. In this respect, another element evident in the case of the Clean Environment Initiative offers some hope. Our analysis of the voting behavior of the sample revealed that cleavages emerged along <u>traditional partisan and ideological lines.</u> The problem of coalition formation to press for the consideration of values adversely affected by technology -- both environmental and non-environmental ones -- is, therefore, less formidable than would be the case if

those opinions were randomly distributed among the population. Thus, because this consumer issue, which may well be representative of the larger class, has engendered much the same alignments as have the more traditional welfare issues, we may find that an equitable bargaining situation can emerge -- one in which no group is a permanent loser.

Finally, we are witnessing many attempts aimed at increasing our knowledge base, which can then be used to establish -- or disconfirm -- putative relationships between the primary capacity and secondary effects of technology. The creation of the Office of Technology Assessment in the last session of Congress, Section 102 of the National Environmental Protection Act which requires "impact statements" before agencies can proceed with major projects, and the technology assessment work such as that done by the MITRE corporation and RAND all are examples of such efforts. To the extent that these are successful in elaborating the rather complex patterns of causality involved in the implementation of technology, other types of consequences -- non-environmental ones in particular -- may become more potent issues in our pluralist arena. Such a development would certainly act to reduce tensions which may arise if no remediation is available for those who feel frustration with the course of technological development.

We have examined something of the history of controversies surrounding the implementation of highly visible, widely spread technological systems. We have seen that there has been an increasing recognition over time that technological development is not Pareto optimal, and, in particular, that the second-order consequences of the primary capacity often affect adversely highly prized values. We have seen that much of the debate centers on those sorts of tradeoffs. We have examined one such conflict which ostensibly dealt with environmental issues only to find that it heralded a plebiscite on more general values affected by technology. Furthermore, we argued that those other values could only be indirectly argued under the guise of ecology because that particular issue enjoyed a relatively "privileged" status in the political arena. This, we suggested, was due to the rather complete set of

cause/effect relationships which linked the adverse consequences to the favorable primary capacity. Finally, we observed that if the tradeoffs remain rather one-sided, tensions could be generated in the political system. Increasing instances of this type of issue coupled with continued cleavages along relatively traditional lines as well as greater knowledge about cause/effect relationships could reduce that tension.

In light of our findings that a major portion of people's hostility towards technology derives from conflict over values advanced by the primary capacity and those impaired by secondary consequences, it is rather surprising to read the conclusion of a recent editorial in Science. The writer urges that "the task before us is to marshall more of technology to the service of human purposes, not to put technology into a self-destruct, reverse-thyself gear. This will not be achieved by a blind wholistic approval of technology but by carefully developing those tools which can be geared to advance our true values."[29] Disregarding the question of how "our true values" can be ascertained, such an argument implicitly accepts the notion that the difficulties technology faces today can be reduced by intelligent and "humane" implementation of additional primary capacities. But such a position clearly seems to have misread the public's mood. The unanticipated and unintended negative side-effects of technology which, more accurately, appear to be the locus of concern actually derive from technologies which in former times had been implemented humanely to "advance our true values." Technical solutions may offer answers to some negative second-order consequences. But they themselves may engender others. Only a proper recognition of the temporary nature of technical solutions will enable us to implement technology in a manner which will move us toward a more fulfilling society.

NOTES

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3. See, for example, John F. Stover, American Railroads (Chicago: University of Chicago Press, 1961).

4. See, for example, Edward Ayres, What's Good for GM... (Nashville: Aurora, 1970) and Kenneth P. Schneider, Autokind vs. Mankind (New York: Norton, 1971).

5. See, for example, Uwe Thomas, Computerized Data Banks in Public Administration (OECD, Paris, 1971).

6. Much of the following information on the effects of barbed-wire comes from Earl W. Hayter, "Barbed Wire Fencing -- a Prairie Invention" Journal of Agricultural History 13 (1939), pp. 189-207.

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12. Emmanuel Mesthene, Harvard University Program on Technology and Society: Fourth Annual Report (1967-68).

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14. Philip Converse, "The Nature of Belief Systems in Mass Publics," in Ideology and Discontent, ed. David Apter (New York: Free Press, 1967), p. 207.

15. We wish to thank the State Data Program of the University of California, Berkeley, for providing this data (note: Data for this study, originally collected by the Field Research Corporation, were provided by the State Data Program of the Institute of Governmental Studies, with the assistance of the Survey Research Center, University of California, Berkeley. These organizations are not responsible for the analysis and interpretation of data appearing here.)

16. Some of this material appears in Todd La Porte and Daniel Metlay, "They Watch and Wonder -- The Public's Attitudes Toward Technology: a Survey," Working Paper no. 6, Institute of Governmental Studies (February, 1973). Currently under Review by Science.

17. San Francisco Chronicle March 13, 1973, p. 12.

18. We wish to thank Professor William Bicker of the University of California's State Data Program for suggesting a method used in ranking these actors.

19. La Porte and Metlay, op. cit., pp. 25ff.

20. Herbert Simon, Administrative Behavior, second ed. (New York: Free Press, 1957), pp. 45-60.

21. Los Angeles Times June 2, 1972, part 2, p. 6.

22. San Francisco Chronicle June 2, 1972, p. 54

23. See, for example, Los Angeles Times, June 2, 1972, part 2, p.1 and June 3, 1972, part 2, p. 4.

24. Memo to Otto N. Miller from Whitaker and Baxter, Inc. Distributed by People's Lobby mimeo n.d., p. 1.

25. Mervin Field, "Trend of Public Opinion has Swung Against Proposition 9," Field Research Corporation Release no. 753, June 3, 1972.

26. Some of those who voted against the Initiative did so for procedural reasons, as opposed to substantive ones. We excluded those who said that the former comprised the only reason for their vote, so that we could more accurately scrutinize the substantive reasons for the vote.

27. From a Whitaker and Baxter memo.

28. J. David Greenstone, Labor in American Politics (New York: Random House, 1969), p. 408.

29. Amitai Etzioni, "Humane Technology," Science (March 9, 1973), p. 959.