



## Environmental Decision Making: Analysis and Values

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### THE POLITICAL FUNCTIONS OF ANALYSIS

In order to understand the reasons for seeking a better means of incorporating “intangible” or “fragile” values into systems analysis, it is necessary to understand the functions analysis fulfills (or might fulfill) in environmental decisions—decisions that are fundamentally political in the sense that they ultimately involve competing or conflicting values, and therefore cannot be resolved by purely “rational” (i.e., empirical and logical-deductive) means.

The usefulness of systems analysis depends on the fact that its conclusions purport to be based on a set of neutral principles that command a wider consensus than those conclusions themselves would be likely to command without a demonstration that they are logically deducible from such principles. In this sense, policy or systems analysis perform a function with respect to political-technological decisions similar to that performed by a judicial process with respect to conflicts between individuals. A court decision is accepted by the disputing parties largely because it is based on a set of rules both parties accept applied through a procedure which both parties are prepared, before knowing its outcome, to accept as unbiased.

Of course, other factors also enter into the parties' willingness to comply: a court has substantial sanctions through which it can impose large additional costs on individuals who refuse to accept its verdicts. Analogous sanctions are not normally available against contending political interests to enforce the conclusions of a policy analysis. In some cases, it has nevertheless been possible to embody

in legislation rules that mandate acceptance of the outcome of a policy analysis. As Robert Dorfman explains in his essay for this volume, one of the earliest such legislative mandates was enacted for water resources projects. There, Congress legislated specific formulas for computing the costs and benefits of a project and set minimum criteria of project acceptability in terms of a benefit-cost ratio. If a project did not meet the criteria, the presumption against it was difficult to overcome, having something like the force of a judicial decision. The existence of such legislated rules tends to reduce political conflict over choices among otherwise controversial projects, largely because the very abstraction and technicality of such rules tend to remove from political visibility all projects to which they are applied.

Indeed, one of the most likely sources of demand for the inclusion of "fragile" values in systems analysis is the hope that, by formulating general rules for incorporating such values into benefit-cost calculations, the analyst can remove political "heat" from the decision maker and can thus help to mitigate confrontation between opposing interests and factions. If such a formulation were successful, it would extend the scope of neutral principles to include the application of new kinds of criteria. As the study of the Tocks Island case has shown, political decision makers do take such values into account in their final decisions even when those values are not included in the supporting analysis. From this perspective, the problem of fragile values is not so much their neglect in the decision making process as it is bringing them into a common intellectual framework with the rest of the analysis in order to remove them from the domain of value conflict in the same way that the other calculations of benefit-cost analysis have muted political conflict over the economic viability of projects.

In principle, the values labeled "fragile," "humane," or "intangible" can be included in the objective functions that are maximized in the analytic process. One can even test a variety of objective functions by assigning different relative weights to the various values or interests whose weighted sum constitutes the function to be maximized. In such cases, a particular policy alternative may turn out to dominate all others over quite a broad range of possible objective functions. The difficulty, of course, is that such a tidy calculus is possible only if one can devise a way of measuring the intangible or "soft" values in the same units as those used for the "harder" values normally studied in cost-benefit analysis. Furthermore, if different groups with an interest in a controversy assign sufficiently different weights to the constituent elements of their

particular objective functions, the range of viable policy alternatives that emerges from applying the same analysis to different objective functions will be too wide, and there will be no way of proceeding further on rational principles alone.

After the study of the Tocks Island Dam proposal, one is entitled to doubt whether the program idealized above is feasible in actual controversies. As Henry Rowen and Laurence Tribe explain more fully in their respective essays in this collection, many of the values we wish to protect are not even clearly defined, and their conventional names mean dramatically different things to different participants in the process. The best that we seem able to hope for at this stage is that systems analysis may help us to measure the costs, in terms of shortfall from other more quantifiable goals (i.e., "shadow prices"), of protecting the relatively ill-defined values we care about. For example, a particular environmental protection measure may prove surprisingly costly in terms of regional economic growth; conversely, it may prove much less costly than the opponents of protective measures initially believed. Quantification of such costs can often lead to reassessment of the intangible values to which they relate, and thus to altered choices.

A second major function of analysis is that it may help us to separate debates over means from debates over ends. Ideally, analysis would enable all those potentially affected by a decision to deduce its consequences for their particular hierarchy of values and preferences. In practice, of course, things never work out as simply as that. Means and ends are not so neatly separable. Both are embedded in a logically interconnected framework that cannot be disassembled value by value or preference by preference. Moreover, values and preferences need not be simply additive. Just as the utilities of different individuals may be interdependent, so may the goals or preferences of a single individual or group. An individual's view of a deeply preferred goal may be substantially modified when he understands the consequences of its achievement for some of his other goals. He might not even be conscious of these other goals until analysis discloses that they are threatened by realization of his highest priority preference. Individual and political attention spans alike are severely limited, and can embrace only a few goals and consequences at one time. Which ones are salient at the time of a particular decision will be profoundly influenced by the context of previous events and the historical setting of public debate. Even though analysis certainly cannot sort out all these effects, it can provide a framework that gives greater continuity and consistency to the process of decision. It can provide a way of keeping a wider range

of values in the focus of attention at the same time, and can thus insure at least a partial separation of arguments over means from disputes about ends.

A third (and sometimes very controversial) function of analysis is to add legitimacy in the public eye to policy decisions. This legitimization works best when the issue has relatively low salience for any particular interest group. In such a case, the public tends to accept a decision that would otherwise be seen as arbitrary, simply because that decision is presented as the consequence of analysis. In part, such acceptance simply reflects the fact that, in a society suspicious of authority in general, science remains the one legitimating process that most can agree on. Because science represents "public knowledge" in the sense of Ziman,<sup>1</sup> its results can in principle be checked by anyone who cares to take enough trouble, regardless of his antecedent values. Because he trusts that the steps are reproducible, he seldom actually bothers to check them. He accepts the conclusions of analysis just as he accepts the value of paper money whose convertibility to gold is seldom tested in practice—so long as there is general trust in the proposition that it *could* be tested if necessary.

When a particular issue reaches high political salience, even if only among special elites, the legitimating function of analysis loses its force. Affected interests will attack the premises or even the techniques of the analysis and will attempt to alter its terms. Often, redefinition of criteria will rebias an analysis in favor of the particular interest or value preference which caused the issue to rise to political salience in the first place. Environmental groups have made effective use of section 102 of the National Environmental Policy Act to alter the terms of analysis for a whole series of major technological projects.<sup>2</sup> The starting point of the project underlying this volume was a desire to alter the terms of analysis of environmental policy issues so as to give greater weight to intangible values. To the extent that such values can be assigned "shadow prices" or be otherwise quantified, the process further legitimates the resulting outcome. It is also true, of course, that the legitimacy provided by analysis can be specious. Mountains of facts and equations can be used, either out of organizational habit or inertia or deliberately, to obfuscate more fundamental issues and to lend the authority of apparent objectivity to decisions made on unacceptable grounds, such as bureaucratic self-interest.

A fourth important function of analysis in the political process occurs when it succeeds in converting apparent zero-sum games into positive-sum games—i.e., when it discloses solutions to a conflict that

satisfy all the parties, if not completely, at least more than they intuitively anticipated was possible. Very often analysis helps to reveal new possibilities, to widen the range of policy choices available. Moreover, as a fifth function, analysis can frequently eliminate from consideration alternatives that are "dominated" by other alternatives, i.e., that are worse no matter what relative weight is given to the various interests or values at issue, at least over a fairly wide range. When analysis succeeds in doing this unambiguously, it becomes a very powerful (and a wholly legitimate) tool of political persuasion.

None of these functions of analysis is entirely separable from the others. The legitimation function is important, for example, because it helps in consensus forming. The shift of the debate from means to consequences can either contribute to or detract from consensus, depending upon circumstances. A clearer understanding and exposition of consequences can expose fundamental value differences that were previously glossed over in the debate over specific means. A consensus on a specific line of action may evaporate when all its consequences are more fully understood. Groups may oppose or favor a specific project for widely differing reasons, and thus form an effective political coalition that would be eroded by more explicit analysis. On the other hand, groups may modify their support or opposition to specific projects when the social costs of achieving their ends are more explicitly set out. In short, analysis can stimulate the reevaluation of values through better understanding of their practical implications, and can change the terms of social valuation, not by operating directly on the values themselves but by clarifying the implications of some values for other values within a single individual's or group's framework of ends.

## THE VALUATION OF NATURE

One of the principal problems of incorporating intangible values in analysis arises from their incomplete or ambiguous definition and articulation. Groups with different perspectives may use the same words for values that represent quite different domains of subjective experience and that trigger quite different subjective images. This is, after all, why we call them intangible. The words are not names for entities of "public knowledge" and are thus unlike "harder" values, which can be given more operational definitions. Thus an essential aspect of dealing rationally with intangible or fragile values is the attempt to reduce them to more operational terms.

As industrial societies have grown more complex and more

affluent, an increasing fraction of the population has come to live in cities. And many city dwellers, because of their mobility, have potential access to nature, including those resources that are both unique and finite—namely, primitive nature and unspoiled wilderness. Many of these areas are such that, the more people use them, the less attractive and valuable they become to those who do have access to them. It is only natural that our cultural valuation of wilderness should increase rapidly as the prospect of its degradation arising from other human uses becomes more widespread. Pristine nature becomes more valuable simply because the demand for it is constantly increasing while the supply is decreasing, both effects being products of industrial civilization. Thus much of the valuation placed on nature is simply a result of its scarcity in a strictly economic sense. But the natural environment is much harder to ration than other scarce goods. For cultural reasons we look upon it as part of the common heritage of all, rather than as something to be rationed by the market alone, accessible to an ever-narrowing minority of the rich as its value increases. In this sense, it partakes of many of the properties of a “merit good” as defined by Musgrave.<sup>3</sup>

Although we must therefore struggle for ways of rationing nature politically rather than economically, we know of no “just” way to do this, giving equal access to all who want it. Uses of nature that benefit many people, including its destruction for economic purposes, are increasingly condemned by society acting collectively. The reason is that the natural environment is felt by many to have an intrinsic value, a value that (incidentally) benefits even those who do not enjoy or benefit from it in any direct way. A majestic piece of scenery, or a unique ecosystem, enhances the quality of a society which possesses and cherishes it just as surely as does a national historical monument, a great work of art, or a cathedral.

In modern societies at least, our valuation of nature is intimately related to our capacity to understand it and to describe it in scientific terms. It is probably no coincidence that the movement to assert the values of nature has been spearheaded by the scientists who understand nature best, and have devoted their lives to its study. The “rights of nature” is a human construct; as Charles Frankel reminds us, the construct represents an effort to institutionalize protection against our being carried away by temporary enthusiasms of exploitation, and against our acting with overconfidence in our ability to foresee the potential consequences. Thus notions such as the “rights of nature” or “fragile values” have a social function analogous to that of taboos or religious beliefs in more traditional cultures. They are, in large part, a surrogate for reasoned collective

decisions, a bow to the complexity we have not yet mastered and must therefore not disturb too much.

One reason such a surrogate is needed is that we possess no scale of values for nature that can be readily weighed in the balance against the fulfillment of man's material needs or desires. To a degree, of course, nature does embody values that are of the same kind we use in computing material benefits. For example, we say that the preservation of nature protects resources for the future, including future generations. The protection of a natural ecosystem is an economic investment for the sake of a future benefit just as assuredly as the development of a mine or the conduct of a research and development program. We can go a long way, at least in principle if not in practice, in treating nature like any other economic investment for a future stream of economic benefits. Even if we are not knowledgeable enough to quantify these future benefits deterministically, we can regard the preservation of nature in the same light as an insurance premium, a hedge against future events or conditions we cannot now foresee. There are many who would argue that this is the only reasonable basis on which to value nature—i.e., that economic self-interest, viewed in the longest range and most sophisticated terms to embrace our descendants as well as ourselves, is a sufficient criterion in principle for incorporating intangible and fragile values in our analysis. If we know very little about the full ramifications of our present interventions in the natural environment, the conventional calculus of decision under uncertainty may suffice to justify at least part of our ecological caution even in the most cold-blooded economic terms.

To whatever extent such economic analysis falls short of making a convincing case for ecological caution, the case remains an appealing one on other grounds. History teaches us that much of the folklore and mythology of the past had an important social function in enabling humanity to cope with environmental complexity it could not scientifically understand. Yet recent science has frequently confirmed the empirical basis at the core of folk wisdom, and it is possible that some future historian will see our romantic views of nature as having served a similar purpose during the age of exploding affluence and material exploitation. Thus we may consider that we are in a sort of transition period in which our analytical capability, and the state of our empirical knowledge, cannot be used in support of a political function for analysis of certain difficult questions, such as the importance of preserving nature.

Rather we must content ourselves with vaguer principles, expressed in terms of values that have something of a mystical and

romantic sound, and that have more in common with traditional taboos and folklore than with rational arguments. However, as our knowledge increases we must be prepared for the fact that some of the previous bases for ecological caution will disappear, and others may be intensified. Ignorance or uncertainty cannot be used indefinitely as a persuasive basis for ecological decision making. We cannot assume that folk wisdom and ethical tradition will necessarily be confirmed by scientific knowledge in the future.

Putting aside the preceding speculations, I think we can discern certain themes in our valuations of nature which it is possible to formulate fairly precisely, even if not quantitatively. Examples of such implicit criteria of valuation are the following:

1. *Uniqueness.* Natural systems that are not duplicated elsewhere have a higher value than those that are more widely distributed. It was the fact that the Delaware was the last free-flowing river in the heart of the industrialized East which gave the Tocks Island Dam project special significance in the eyes of environmentalists, and helped mobilize opposition to it.
2. *Reversibility or resilience.* Actions that are irreversible, or reversible only at huge cost, should carry a much heavier burden of proof than actions that may affect unique and beautiful, but relatively resilient, environments. An oil pipeline across the permafrost regions of Alaska justifiably arouses more alarm than the bulldozing of a fine beech forest in rural Virginia. The beech forest is a sad loss, but it will grow back some day if we change our minds, whereas the disturbance of the permafrost *may* trigger a progressive chain reaction of deterioration that we can never stop, as for example did the overgrazing of the hills of North Africa. At least it is this belief that conditions many of our attitudes, whether or not it is actually valid. The Corps of Engineers, in the Tocks case, recognized this point of view even if only with tongue in cheek when it argued that the Tocks Island Dam could be removed at some later time if that proved necessary.
3. *Beauty.* An important component of society's valuation of nature is esthetic. No less than a human artifact, natural beauty is a culture object. Tastes in nature change just as do tastes in art or music, though some tastes are more permanent than others, and the most majestic and awesome spectacles of nature, such as the Grand Canyon, seem to have an almost universal and timeless appeal.



4. *Human life support.* This is the aspect of nature that, in principle, is most easily subject to analysis in the same terms as material benefits and costs. Thus, for example, the preservation of wild genetic stocks of major food plants may be essential at some time in the future for the restoration, through breeding, of agricultural monocultures attacked by new varieties of pathogens or pests. The protection of the ecology of coastal estuaries that play a part in the life cycle of oceanic fish stocks may be essential to maintenance of marine fisheries. Thus the value of a particular feature of nature as part of the future human habitat becomes one of the criteria for its preservation or restoration.
  
5. *Naturalness.* This is an especially elusive criterion, but one that nevertheless seems to play an important part in debates over natural preservation. A part of nature that evolves free of any human intervention whatever is regarded as having a special value in its own right. A piece of undisturbed nature is more valuable than an equally attractive natural system maintained by human cultivation. This has not always been so; it represents a distinctively modern attitude probably brought about by the increasing rarity of truly natural environments, and by the growing sense that people need *something* in their environments that is not of their own making or shaping, if only because they would be lost in a universe that simply mirrored themselves (see Laurence Tribe's essay in this volume). The attitude is illustrated by the recent change in approach to the control of forest fires. In many areas, firefighting is now regarded as an undesirable human intervention in the natural succession of the forest ecosystem. To some extent this change in approach to forest fires may have an objective scientific basis, but it is also to a considerable extent the result of an emotional reaction to any interference with the "natural order of things." Clearly in the case of Tocks, the wild river was seen as having a special value arising from its "naturalness," a feature that would have been valued even if it could be demonstrated that an artificial lake could have been made more beautiful. To some extent this intrinsic valuation of naturalness can be traced back to what I have said about preservation of nature as insurance against human ignorance, against the unpredictable consequences of intervention, but I believe that the feeling goes deeper than any justification one could develop in purely rational terms.

These five criteria for the valuation of nature are not entirely independent of one another. Naturalness and uniqueness both

contribute to our sense of beauty, for example. Naturalness and reversibility both relate to the preservation of future human life support. Beauty of natural surroundings may be essential to the future psychological well-being of humanity. Nevertheless, each of the criteria has a distinct identity in the public debates over preservation. There is no independent, rational basis for assigning a price to such criteria in a cost-benefit analysis, but defining the criteria is an important first step that can aid analysis by permitting testing of the impact of various assigned prices. For example, it should be possible to assign a scale of values to uniqueness, though different groups may disagree about the dollar value of a unit on the scale, so that the scale may be expanded or contracted in the eyes of different beholders.

#### PROJECT ASSESSMENT VS. PROBLEM ASSESSMENT

It is difficult to fault analysis for its failure to deal with "intangible" values when, even in its own "hard-headed" terms, it is poorly done. For example, in the case of the Tocks Island Dam, the most striking characteristic of the analysis is its poor and incomplete character even when judged in the narrowest terms. One does not have to invoke "humane" values to justify serious reconsideration of the Tocks proposal; there may be no deficiency in the decision or in the analysis that a good "technical fix" would not cure. Robert Dorfman lets the cat out of the bag when he admits "there are such technical difficulties in the design of the project that it seems unlikely to work out as idyllically as described in the text," after a glowing description of a Sunday outing of a "poor or near-poor" family from New York or Philadelphia. (See his essay in this volume.)

Many of the faults of the Tocks Island decision process can be related to an inadequate choice of the boundaries of the system to be studied. The analysis was a project-oriented assessment rather than a problem-oriented assessment. It looked at each of the different problems to whose solution Tocks might contribute, but it did not search widely for the optimum way of dealing with any single one of those problems. Those problems included flood control, water supply, energy supply, salinity control, and recreation. In computing the benefits from a multipurpose, single-technology project such as Tocks, one is too likely to overlook alternative solutions to each of the separate "problems" represented by each purpose. In addition, the baseline against which the benefits of the project are measured is vague, since we do not know what would have happened in the

absence of the project, for example, under the influence of market forces alone. Would the uncoordinated development of second homes, condominiums, and private recreation facilities end by being more damaging to the environment of the area than a planned recreation area or than the dam? The comparison of costs and benefits is not properly between the project in question and an unchanged environment, yet this appears to be the way it was implicitly evaluated. Would the rigid control of local development have been the actual policy alternative chosen if the Tocks project had been rejected by the voters?

In the case of flood protection, there are many other alternatives for achieving such protection, including flood-plain zoning, properly designed flood insurance, and quick-reaction warning and prediction systems.<sup>4</sup> Still other alternatives are possible, such as controls on the upper watershed and tributaries, high-flow skimming, and the like. High-flow skimming has been mentioned in connection with water supply, but it can have flood control implications as well.

Thus, before one can readily apply multipurpose analysis to a case such as Tocks, one should really carry out a series of single-purpose problem analyses for each of the problem areas mentioned above, with the system boundaries for each problem carefully chosen to take into account a number of possible external interactions. This may imply a different system boundary for each problem, as well as consideration of alternate ways of drawing the boundary.

The way the water supply question has been dealt with in the Tocks case offers many examples in which failure to consider external interactions resulted in arbitrary and unjustified assumptions in the analysis—e.g., the diversion of upper Delaware water to the New York City water supply, the failure to consider leaks and wastage in the New York City system, the failure to consider ground water as an emergency source of low-flow augmentation, the failure to consider recycling of water as an alternative to dissipative use, the failure to consider alternative locations for power plants to make less consumptive use of fresh water.<sup>5</sup> Even in hard-headed economic terms, many of these alternatives might have offered benefits greater than those of the Tocks investment, without any worry about “humane” values. As Robert Socolow has emphasized, the boundary conditions of analysis are often chosen to fit into political constraints of long standing, whose origins are so far in the past that nobody remembers the rationale for them.

Almost all the problem areas to which the Tocks project purports to be addressed have been incompletely analyzed. There has never been a truly comprehensive study of the recreational requirements

for the metropolitan areas of New York and Philadelphia, an analysis that included transportation requirements, and that took into account the changing educational levels and tastes of the populations involved. The National Academy of Sciences' study of Jamaica Bay, for example, disclosed many possibilities for recreational development much closer to the metropolitan area,<sup>6</sup> but no analysis of Tocks ever compared the project with these alternatives. There has apparently never been a comprehensive study of the future energy requirements of the Delaware Basin region that takes into account conservation possibilities, alternative forms of power plant cooling, and the possibilities of importation of energy from outside the region.

The feedback between population and industrial growth on the one hand, and the provision of infrastructure facilities such as power, water, and transportation on the other, has apparently never been factored into regional development studies. On the contrary, growth of population and industry have been treated as exogenous variables, and the needed infrastructure has been calculated on this basis without considering the degree to which provision of this infrastructure would accelerate development or its absence would retard regional growth. The ground water system of the region has never been fully explored, and seems not to have been taken into account in the assessment of the region's water supply. Even the carefully computed recreational benefits of the Tocks reservoir are subject to large uncertainties arising from the possible eutrophication of the reservoir as a consequence of upstream agricultural activities, and no adequate program to resolve these uncertainties has been developed.

The eutrophication problem could invalidate the whole economic analysis of the recreation benefits, which is predicated on water quality in the reservoir adequate for boating, swimming, and other water centered recreation activities. The situation is similar to that which occurred in the case of the sonic boom problem in connection with the SST: much of the economic analysis on which the assessment of the SST was based depended on the assumption that overland flights would not be precluded by adverse public reactions to the boom. What these examples suggest is that it is important to establish priorities for analysis in order to avoid elaborate investigations based on assumptions vulnerable to invalidation by adequate analysis of other parts of the problem. There are hierarchies of topics for analysis that must be respected if the analysis process is not to be wasteful and irrelevant.

The reasons for the various limitations of the Tocks analysis are, of course, implicit in the history and politics of the issue. Many

assumptions in the analysis were locked in by previous legal or political commitments, and simply became rigid and arbitrary constraints that made no sense in a more comprehensive context. As Irene Thomson observes in her essay in this volume, the different political decision makers had quite different perceptions of the issue, depending on how the costs could be expected to fall on their own particular political constituencies. Certain numbers, such as the 3,000 cfs low-flow requirement at Trenton, acquired the status of unexaminable premises and were used to provide urgent justification for the 3000 cfs flow to be assured by the Tocks Island Dam. This was because the Delaware was considered as a closed system, with external boundary conditions that could not be modified or relaxed. The hidden agenda of each of the analytical groups led it, perhaps unconsciously, to structure the boundaries of the problem so as to support an outcome favorable to its bureaucratic or other unmentionable interests. The assumptions became partially unlocked only as various adversary interests entered the political picture and began to provide new analyses with assumptions slanted to generate outcomes that favored their own a priori preferences. Biased analysis highlighted the unconscious biases in earlier analyses, if only by providing contrast.

Why should the various actors be so shy about "fragile" values, concealing them under apparently hard-headed analysis carefully pre-designed so that the outcome would favor their unacknowledged values? The reason is essentially political. In the American polity, hard-headed arguments have usually been more effective in achieving consensus than arguments deriving from very generally stated national goals. If an alternative can be eliminated from consideration on the basis of technico-economic arguments, it is less necessary to argue from premises on which different social groups are likely to differ profoundly, such as growth vs. equilibrium. On the other side, consensus objectives, if they do exist, are usually stated so generally and abstractly that neither the public nor the decision maker can translate them into concrete policies on real issues. For example, nobody will overtly argue against fragile values; they will simply behave as though they were not relevant to the particular decision at hand.

I suspect that, as one extends the boundaries of the system with respect to which policy analysis is conducted, the difference in outcome between hard-headed analysis and analysis that takes greater account of humane values may narrow. I cannot prove this, but until analysis is conducted in the broadest possible terms, it seems to be a good working hypothesis. As the boundaries widen, the

effects of an action on more and more people are included, and it is more likely that new values will be introduced into the analysis. As I have suggested in the section on the valuation of nature, a proper consideration of the need to preserve the future human habitat or of the psychosocial benefits of exposure to unspoiled nature may be sufficient to justify protection without appealing to more intangible arguments.

The undesired outcomes of the incomplete and partial analyses so far put forward are not convincing evidence that it is necessary to find ways of quantifying fragile values. The problem at present seems to be that analysts are more constrained than they are willing to admit by the political and social presuppositions of the milieu in which they work. Indeed, their own professional commitment to the value of analysis tends to blind them to these constraints. Much cost-benefit analysis seems to be conducted by economists and engineers with a trained incapacity to appreciate political factors, and indeed a contempt for politics as somehow an unreal and artificial constraint outside the real world of hydraulic flows and dollars. The main function of the injection of new values into the analysis (as by environmental groups, for example) is to catalyze a widening of the terms of analysis, the range of alternatives, and the boundaries of the system to be analyzed. They are just that, catalysts that promote better analysis, rather than necessary ingredients.

## THE BURDEN OF PROOF

There has been a real change in the climate of public opinion, which has shifted the burden of proof as between the advocates of growth and development and the advocates of restraint. The deployment of new technology, or new public or private investments, is now increasingly regarded as potentially deleterious until proved harmless, whereas formerly it was considered innocent until proved damaging.<sup>7</sup> Much more weight is attached now than in the past to the preservation of options for the future; society is more inclined to favor actions that can be changed or reversed in the light of new knowledge or experience as compared with actions that involve less easily reversible long term commitments. In fact, the identification of "irreversible commitments" is one of the criteria explicitly mentioned in the requirements for the environmental impact statements mandated in NEPA.<sup>8</sup> Thus flood-plain zoning may be inherently preferable to large scale dams because future policy can be

adjusted in the light of experience.

Where a choice is presented between investment to make more efficient use of a resource as compared with investment in increased supply, the former is to be preferred because there is less uncertainty about its secondary effects, and the option of investing in increased supply at a later time still remains open. As the externalities of increased supply are increasingly internalized in the cost of a resource—including the environment itself—more efficient use of resources becomes more attractive economically in comparison with increasing the supply. This is true in the case of free goods such as water, clean air, flood-plain land, and, to a growing extent, other goods such as energy and materials. We are still in a transition stage within this change.

The shift of the burden of proof also leads into a rebalancing of effort between design and analysis, in favor of analysis. Many of the examples cited in our discussion of Tocks suggest that better analysis is cheap in comparison with the mistakes and unforeseen consequences resulting from permanent investment. History has demonstrated the almost total invalidity, and indeed irrelevance, of the original Corps of Engineers studies of the expected costs and benefits of Tocks. It was the shift in the burden of proof that occurred between the time of the original plan and the DRBC study that required a better analysis, and the continuing debate on the project provided the time and basis for additional study. What this shows is that much effort devoted to detailed design of concrete projects can be wasted if detailed project design is not preceded by a comprehensive and wide ranging but relatively general assessment of the potential effects of the project and of alternative approaches to the problems that the project was intended to solve. Much of the analytical effort devoted to design might better be devoted, at least initially, to assessment and the approximate exploration of a wide variety of options, rather than to the detailed design of a few.

## **PARTICIPATORY DECISION MAKING**

During recent years there has been a sudden upsurge in emphasis on the importance of public participation in decisions about the application or deployment of technology. Laurence Tribe's essay takes the view that the process by which a result is arrived at is often at least as important as the result itself, so that one cannot judge the value of a decision by looking at its outcome alone. Some advocates of participatory decision making indeed appear to believe that the

process is far more important than the outcome—that in fact there is no truly independent way of judging an outcome other than by judging the process by which it was reached.

Now process *is* very important. This is so in part because the choices involved in a project such as Tocks are to a certain extent dependent on the surrounding culture, and cannot be made entirely on the basis of strictly rational or even easily articulated criteria. To the extent that the ultimate criteria of choice are intangible and unquantifiable, it is only the process of choice that can validate or legitimize the outcome in the eyes of society. In this sense it is really the process that defines the criteria, and even quantifies them after the fact. Indeed, the outcome of any choice that involves unquantifiable elements implicitly quantifies these elements. Society's choice of speed limits and the costs it is willing to accept for safety features in automobile and highway design represent implicit valuations of human life and suffering from auto accidents.

It is for this reason that I agree with Robert Dorfman on the necessity for a disciplined process of making major decisions about the deployment of technology, with rigorous standards governing the admissibility of arguments and evidence and determining what interests and representatives have standing in the process. The purpose of Dorfman's court should be in part to allocate analytical resources among relevant interests, including those that represent "elite," or "intangible," or "fragile" values. There are obvious difficulties, however, with the normal political process: it is disorderly and undisciplined, and it provides insufficient guarantees that all the relevant values and interests will be considered. Furthermore, present processes often invite paralysis in the resolution of issues.

In the United States, political preference has tended to alternate between political participation and professional management. When the public at large becomes disgusted with the paralysis of decision making occasioned by excessive deference to parochial interests and political logrolling, it opts for the technocrats; when it becomes disillusioned with the arbitrary and impersonal power of the technocrats, it opts for greater participation. The early days of the Kennedy administration represented the high water mark of public confidence in experts and professionals and the willingness to believe that the major problems facing America could be attacked with technical and administrative skills that were largely "apolitical." Arthur Schlesinger quotes Kennedy as saying that the real issue at that time (1963) was the management of industrial society—a problem not of ideology but of administration.<sup>9</sup>



But just as the intellectuals were proclaiming the end of ideology, the public began to swing away from this position. New constituencies began to be heard from who regarded expertise and professionalism as camouflage for the preservation of existing power relations. The Vietnam War was seen as a war made by technocrats, its shots called by experts who accepted as an unexamined premise U.S. national interest in the preservation of the South Vietnam regime as a bulwark against communism, and who were concerned with the most effective political, economic, military, and technological means to that end. The revolt against this technocratic style of decision making rapidly spread to all phases of the political process. In part it represented a generational change. It seems likely, however, that we are now in an extreme swing of a reaction towards "open" government, and that we will look back on the present period with some of the same feeling of amazement and rejection that many of us now feel towards the years 1955-65.

The present emphasis on participatory decision making (the opposite of technocratic decision making) is a reaction not only against Vietnam but also against the technically oriented public authorities with minimal political accountability who were so much a feature of public works projects in the 1930s and 1940s (and to some extent even into the 1950s). What currently fashionable participatory decision making is *against* is clearly and graphically described in a series of four articles by R.A. Caro on Robert Moses and his control of public works in New York City that appeared in *The New Yorker*.<sup>10</sup> In Caro's words:

... Moses was not responsible to the public. Its votes had not put him in office, and its votes could not remove him from office. He despised its opinion. The considerations that he took into account were the considerations that mattered to him personally: the project, in and for itself; the engineering considerations that would get it done the fastest and cheapest way; and the economic considerations that mattered to the forces he was using to impose his will on the city.

To a considerable extent policy analysis as practiced in the Tocks case was in this tradition. Indeed, the project was caught in the transition from the climate of opinion that made possible the situation caricatured in the career of Robert Moses to an entirely new situation—one caricatured by the legal battles and court decisions surrounding the siting of nuclear power plants in the late 1960s.

A central question, of course, is whether the new mode of

participatory decision making is any more viable than was the old one of engineering and economic autocracy. The Moses system, like the traditions of the Corps of Engineers, "got things done," but that system was almost totally unresponsive to the public in any specific way. The new system is more responsive to the public—or at least to some publics—but there is grave doubt as to whether it can get things done. The twelve years of Tocks have not led to any final resolution of the issues, but have simply delayed decision time after time. While there is no question that participatory decision making can stop, and has stopped, possibly undesirable projects, it remains to be seen whether it can ever initiate desirable or needed actions involving the positive use of technology in the public interest.

The case has been well made for the value of adversary analysis in bringing new considerations and perspectives into the decision making process; in the case of Tocks, it prevented the acceptance of analyses that proved in retrospect to be seriously flawed, even from a strictly technocratic standpoint. It produced a pause for reflection, which in this case was almost certainly desirable. To this extent, wider public participation was a virtue. But I have yet to hear of an example in which public participation in the sense desired by its advocates has accelerated a technological project that was badly needed.

The participatory process gives unusual leverage to local or parochial interests that are adversely affected by a project, whereas more diffuse and generalized benefits tend to go unrepresented unless the public benefit happens also to be beneficial to a powerful economic interest, such as a public utility or a construction union. Such economic interests have been widely discredited in recent years; their interests are usually assumed to be contrary to "the public interest" by definition, though there is no inherent logic that dictates that this must be so. Of course, the power of local interests is enhanced when assessments are made in terms of projects rather than problems: it is easier to mobilize opposition to a particular project whose victims are well identified but whose beneficiaries are not so clearly defined. It would probably have been easier to generate a wide consensus on the need for additional recreation facilities for metropolitan residents in the mid Atlantic region, and then to decide later on the most appropriate character and locations for such facilities rather than put forward one option and justify it by its recreational benefits, almost as an afterthought.

One has to be cautious, however, in discussing the meaning of political accountability. It is true that Robert Moses rode roughshod over the rights and preferences of many local communities and neighborhoods, but he enjoyed immense political popularity and

prestige with the New York State electorate as a whole, and few local politicians dared oppose his projects publicly. If a referendum had been conducted on his far-flung activities, he would almost certainly have won it hands down, because he was regarded as being "for progress," and was moving in step with the broad political currents of his time. This is so despite the fact that much of his power was exercised behind closed doors, and that he was not above using strong-arm tactics and thinly disguised bribery to keep local politicians as his allies and supporters. "Buying off" parochial interests in order to defuse opposition to projects deemed by many to be in the larger public interest has been a standard technique of successful technocrats, though seldom acknowledged publicly.

Advocacy of participatory decision making inevitably raises the questions: Who should participate? How should the participants be identified? The central argument in favor of technocracy was always that technocrats could consider the broad public good, unpressured by special interests and random political winds. Today we are more aware that technocrats have their own axes to grind, that they are not intrinsically more selfless or dedicated to the public weal than is the average politician; it is just that they have different axes to grind. They are not outside the political game; they are a part of it.

The ultimate difficulty with participatory decision processes is the lack of assurance that all the relevant interests and perspectives will be represented in a balanced way. Mobilization of a particular affected constituency may depend on accidents of leadership or of command over financial resources. Many affected groups may not even perceive that their interests are involved. Others may be young children, or unborn future generations. As many have stressed, people's needs and wants are not givens, but depend (among other things) on their knowledge of what is possible or available. Thus the attempts of analysts empirically to discover social goals by means of surveys or by indirect inference from social behavior were doomed to inadequacy from the start. Moreover, as Laurence Tribe and Robert Dorfman have emphasized, consumer preferences and political priorities are highly subject to manipulation or conditioning and thus cannot be regarded as "given," even if the current techniques for discovering them were less technically flawed.

What seems to be called for at this stage is a new synthesis of the participatory and technocratic styles. Indeed it is just this sort of synthesis that seems to be envisioned in the procedure proposed by Dorfman, an effort to cope with the undisciplined nature of participatory decision making as currently practiced. But I think a two-stage process is necessary. The first stage I envision would be

much as Dorfman proposed it: a number of adversary analyses would be presented, with allocation of budgets for the analytical work being the responsibility of some neutral, quasi-judicial body. But who is to sort out the adversary analyses? The busy "decision maker" (who is really plural, as Dorfman says) surely lacks both the time and the attention span necessary to evaluate complex and conflicting studies, and the general public or its self-appointed spokesmen are not qualified to do so.

There needs to be an institution something like a technical-analytical court, an organization with the technical competence to deal with the various adversary analyses on their own terms, comparing their assumptions, their formulations of the problem, their methodology, the boundaries of their analyses, and their data. In the language of technology assessment, the institution needed is an assessor of assessors,<sup>11</sup> although what I have in mind is more disciplined than what has been contemplated in the technology assessment literature. Part of the objective of this second-stage assessment would be to clarify and explain the choices before the public—or, more accurately, before the various publics potentially affected by the decision. I would not urge that this clarification be intended fully to depoliticize the process of decision, or that it be designed to effect a complete separation of means and ends. I would urge it as a second approximation to such a separation, a stage beyond traditional policy analysis.

Of course the accountable decision makers in the political realm will (and should continue to) make the final decisions, but they ought to have available to them not only the raw data and analyses. They ought also to have available a simplified and summarized analysis that is a critique of the technically sophisticated analyses produced by the many adversaries addressing the issue. In this way, one might realistically hope simultaneously to optimize the political role played by analysis itself; to strike a wise balance between problem and project assessment; to draw on the strengths of both the technocratic and political modes of decision; and to move toward a balanced and sensitive allocation of the many burdens of uncertainty, both factual and normative, that necessarily beset our halting efforts to arrive at appropriate valuations of nature.

## NOTES

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6. *Jamaica Bay and Kennedy Airport, A Multidisciplinary Environmental Study*, 2 vols., (Washington, D.C.: National Academy of Sciences-National Academy of Engineering, 1971), ISBN 0-309-01871-4, L. C. No. 78-610437.

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8. The National Environmental Policy Act of 1969, sec. 102.

9. Arthur Schlesinger, Jr., *A Thousand Days*, (Boston: Houghton Mifflin, 1965), p. 644.

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