Chapter Six

Policy Analysis as Heuristic Aid: The Design of Means, Ends, and Institutions

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"Policy analysis" refers to a set of procedures for inventing, exploring, and comparing the alternatives available for achieving certain social ends—and for inventing, exploring, and comparing the alternative ends themselves—in a world limited in knowledge, in resources and in rationality. Policy analysts use scientific data and theories as inputs, employ the method of science in many of their procedures, and sometimes stimulate the creation of new fundamental knowledge, but theirs is not a science. Rather, it is a profession—possibly a bit beyond the state of medicine early in this century, when Lawrence J. Henderson asserted that the average patient who came into contact with the average physician stood an even chance of benefiting from the encounter.

I

Policy analysis can be put to many uses. It can be used to help make routine decisions (e.g., the optimization of a system for responding to fire alarms) and to help make decisions on nonroutine events (e.g., the structuring of the main features of a national health insurance system). It can be used to raise questions about, and explore the consistency among, objectives of the same or different government programs (e.g., programs to increase irrigated agricultural land versus programs that remove land from cultivation). It can be employed in advocacy against competition (e.g., by the Air Force and Navy on the merits of their respective strategic nuclear forces). It can provide nonmembers of powerful bureaucracies (e.g., political appointees) with arguments against some of these bureaucracies' programs at the same time that it helps the bureaucracies to fight back. And it can

point to directions for seeking new knowledge that might eventually contribute to solving policy problems (e.g., the effect of environmental stimulation on early childhood development). Policy analysis can be used in all of these many ways, and, in its now quite substantial history, it has been so used.

Policy analysts therefore play many roles. They are staff advisors to decision makers, or may even be decision makers themselves with their thinking caps on. They are members of career services. They can also be found in firms which sell analytic services. Important concentrations of them are to be found in research institutions and universities. Theirs is a peripatetic community. The diffusion of ideas and methods is greatly promoted by the movement of analysts from place to place. They bring or develop subject area expertise, institutional knowledge, quantitative analytic skills, problem solving skills, and occasionally skills in communicating the nature and validity of their findings to decision makers and wider audiences.

In some of these roles, analysts are overtly partisan; in others less so. (Wherever they are located, many analysts have some values that do not correspond in any obvious way to those of the institutional setting in which they work.) But it is not required that analysts be completely nonpartisan, assuming that we could identify zero on a scale of partisanship. Analysts need be no more neutral in their fields nor saintly in their character than are contributors to pure science. But whatever the appearance or reality of partisanship, what matters is the work done and the applicable standard of evaluation is that of the scientific method: careful use of data, explicitness in stating assumptions and the production of replicable calculations. Moreover, partisanship has social value because it can be a motivator of discoveries that affect policy choices. "Blowing the opposition out of the water" may not be the most noble of motives but it may have useful social consequences.

With so varied a set of purposes and players, what, if anything, can be said about the characteristics of good analysis? In my view, good analysis does the following:

1. Uses methods tailored to the character of the problem and the nature of the data; treats data skeptically.
2. Explores, reformulates, and invents objectives; recognizes the multiplicity of the objectives that are held; recognizes hierarchies of objectives and the fact that one is always working on intermediate objectives.

3. Uses criteria of choice sensitively and with caution, giving weight to qualitative as well as quantitative factors.
4. Emphasizes the design and invention of alternatives; tries to avoid concentration on too narrow a set of alternatives.
5. Handles uncertainty explicitly.
6. Evidences that the analyst understands the central technical facts of the problem.
7. Uses simple models to illuminate important aspects of the problem and avoids large models that purport to represent much of reality but that conceal the basic structure of the problem and uncertainties among parameters.
8. Displays truth in labeling of assumptions, values, uncertainties, hypotheses, and conjectures.
9. Shows understanding that the task is usually not to optimize but only to find better alternatives.
10. Shows that an effort has been made to understand decision makers' problems and constraints especially if the analyst proposes a radical reformulation of the problem.
11. Tries to take into account the organizational factors that shape the alternatives generated and influence the outcomes of decisions.
12. Exhibits awareness of the usefulness of partial analysis and of the limits of analysis generally.

This may seem counsel of perfection. If institutional arrangements invariably provided for review, criticism and counteranalysis of analytic work, these characteristics would be more in evidence than they are. Indeed, it might be argued that although no single analysis is likely to exhibit all of the desirable properties listed above, the corpus of analytic work done on a problem over time may approximate this ideal. This may leave uncomfortable those who, although rejecting the model of decision makers as philosopher-kings, conceive of policy analysts as philosopher advisors to kings. I am inclined to see analysts in a more modest role, equipped with certain tools, and subject, intermittently and imperfectly, to certain standards of performance, and therefore to place more reliance on a competitive analytic process.

Points 2 and 3 from this list, concerning objectives, criteria and the handling of qualitative factors, have been central to our project and deserve particular attention. These are not just matters of analytic technique; they are intimately connected to ways we form

preferences and to the role of performance indicators in our institutional structures. I will return to this topic later.

II

Robert Dorfman's essay in this volume traces the historical evolution of policy analysis from maximization under constraint, through recognition of the importance of choosing the objective function, to a greater concern about values. Clearly there has been an evolution along these lines, but this characterization gives insufficient emphasis to what I believe have been two principal contributions of this line of work: clarification of issues, and the design and invention of objectives and alternatives. This view is in marked contrast to the emphasis placed on optimization and evaluation in the literature on this subject. It is not that the latter are not useful, indeed often necessary, activities, but that the payoffs from the former are so much greater. As Edward Quade has put it, "A good new idea is worth a thousand evaluations." (But a good evaluation may be a condition for getting a good idea.) More fundamentally, this view is based on the observation that those responsible for policy choices often do not have a clear concept of what needs to be done, are not in possession of the relevant facts, do not know the alternatives available and do not know, even approximately, the consequences of choosing particular courses of action. Let us refer to someone in this state of mind as being in Position A.[1]

The salient facts about Position A are these:

First, often those responsible for making public policy decisions do not have clearly articulated or well defined preferences among broad goals nor preferences among specific policy objectives. One reason is that the policy issues involved often concern public goods—goods not sold on markets. The value placed on these goods by members of the community is largely unknown because they have few occasions to obtain information on what these goods are worth to them or what they cost. This is also true in the related phenomenon of spillovers from private actions, if the effects are diffused among large numbers of people, few of whom are affected strongly enough to voice concern.[2] In these and other circumstances, decision makers are unlikely to possess strong personal preferences nor are they likely to receive strong signals from the environment. The existence of wide agreement on broad social goals such as economic growth, wilderness preservation, or improvement in the situation of the poor, does not help much in dealing with specific problems as they arise. Therefore, especially for choices which

involve unfamiliar factors and thus are of a nonroutine sort, considered preferences will be confined to choices that bear on subordinate issues rather than on the larger ones.

Second, the nature of the problem may be obscure. The occasion for believing that "something should be done" may be the emergence of a symptom (e.g., an unexpected increase in a price index), an event (e.g., the failure of New York City to sell a bond issue), a new technological possibility (e.g., a report that asserts that supersonic transportation is technically feasible), a proposal (e.g., for building a dam on the Delaware River). The event that brings the problem to the top of the action agenda focuses attention but does not define it well enough for sensible decision. Instead, events generate a search for information about the problem and possible alternative courses of action and objectives. The ends to be sought and the means that might be employed are a joint product of the inquiry undertaken.

Third, available "solutions" are unpersuasive. They do not seem to deal with the problem, however it is perceived; they seem infeasible, or at least too costly. And even if some appear at first glance to be adequate, there may be large uncertainties about how well they would really work.

Fourth, policy decisions are, in general, not made by single individuals acting over time. Nor are they usually made by a group of people acting jointly in committee. They are usually shaped instead by the interaction over time and space of individuals with different attitudes, skills, information, and influence. Most of the participants operate in organizations with missions that inevitably filter data and shape the policy alternatives generated. Organizational biases often interfere with the process of consensus building. But agreement on the consequences of choices and values is not needed for action and therefore normally does not occur. All that is essential is agreement on the next step.

In Position A, therefore, a decision maker must develop or construct his preferences and the alternatives for meeting them. He does this by using methods that have worked in the past for himself or for others in similar situations; or he defines away the problem by declaring that it falls within existing policy; or he uses intuition; or he calls on expert advice; or he fools around with data in different ways and tries out different objectives and alternatives. To those in Position A, *the contribution of policy analysis is essentially heuristic: to provide a conceptual framework (or several) for relating means to ends, for thinking about ends, for identifying the existing technical alternatives, and for inventing new ones.*

The analysis of Tocks provides examples of a heuristic process at

work. Although most of the participants may have begun with a notion—indeed, a conviction—about what was the "right" thing to do, the process of investigation did turn up some new things: alternative means of providing various degrees of flood control, clarification about the different kinds of recreation that would be provided by dam and no-dam alternatives, ideas about other sources of water for New Jersey. Quite a few forecasts were made, about water quality and population growth for instance. I do not know what the total effect of these estimates and alternatives was on the analyst participants or on the governors who have recently made some decisions on Tocks, but it seems to me more plausible to conjecture that many of the participants went through a learning process than that they merely generated—or received—inputs for some predetermined objective functions.

In short, for many participants the analytic process will contribute to beliefs about facts and relationships and will help in the construction of value preferences. The phrase "construction of value preferences" is deliberately chosen. This reflects the view that preferences are generally built through experience and through learning about facts, about relationships, and about consequences. It is not that values are latent and only need to be "discovered" or "revealed." There is a potentially infinite number of values; they are not equally useful or valid, and part of the task of analysis is to develop ones that seem especially "right" and useful and that might become widely shared. Because value preferences are formed through a process of choice in specific cultural and institutional settings, and because, as Laurence Tribe observes, avoidance of dissonance causes us to prefer what we have chosen, the factors that influence our choices get imbedded in our values. Those that are fuzzy, fragile, not immediately useful, are likely to be excluded and therefore are not built into the value system that we are constantly constructing and reconstructing.

III

Another decision maker is in a different position (let us call it Position B)—a position he perceives as less ambiguous than Position A because he has well defined objectives. (Other people may believe that his goals *should* be different ones.) He is looking for better alternatives, perhaps even for an optimum. He may engage in a vigorous search for alternatives. He will probably look for it by searching in the neighborhood of other alternatives that have worked well for him in the past or seem to have worked well for others in

similar situations.[3] If this isn't sufficient, he may have to do more serious searching over a wider domain. He may put his analytic staff to work inventing broadly different alternatives. Here also is to be found the policy maker who has a "solution" and is looking for a problem (e.g., a bureau head looking for business for his agency). He may put his analytic staff to work identifying unmet or inventing hitherto unknown needs of whose importance other decision makers might be persuaded, along with the desirability of his solution.

Recently, a search process was engaged in by the National Aeronautics and Space Administration as it neared the end of the Apollo Program. The "solution" was employment for the existing manned space program. An extensive search was undertaken for jobs to be done through that program within budgets that might be available. During the course of these analyses, a good deal of work and a certain amount of ingenuity was applied to the problem of defining tasks that could be done by men in space and in arguing that the benefits would exceed the costs. The Corps of Engineers' advocacy of the Tocks Island Dam on the Delaware River looks like a similar case. Much of the behavior of government agencies is similarly motivated. Agencies have product lines or specialized services that they promote in the political marketplace, and they sometimes use the tools of analysis both to help improve their products and to help sell them.

Often, nongovernmental (although not necessarily nonpartisan) analysts are also to be found in Position B. The analyst who "knows" it is a terrible mistake to build a large dam at Tocks *has* his values. What analysis can do for him is to marshall the evidence on the costs and benefits of proceeding with this project, to spell out consequences that may have been overlooked, and—most important—to provide a framework for proposing alternatives (e.g., different ways of providing flood control on the Delaware flood plain).

A person in Position B is more likely than one in A to perceive analysis as useful, not only heuristically, but also in providing what might be called a "decision rule" for choosing a preferred alternative. However, the decision rule use of analysis requires that outputs be well defined, quantifiable, and preferably reducible to the same currency as costs, or at least that enough of them can be so expressed to make it a useful exercise. This is unlikely to be possible in the case of larger and more complex policy issues that arise and more likely to work on repetitive and narrower questions. In both, however, there is a significant role for design and invention. Indeed, it is in circumstances in which commitments to policies and programs are strongest, where conflicts with other explicit public purposes or with

poorly represented values are greatest, that inventive ingenuity is most valuable. The invention of new possibilities may help shift policy choices away from perhaps intractable zero-sum choices to nonzero-sum choices—from choices where what some people gain others lose to those where there are gains for all.

Policy analysis, as described so far, would seem to be an unalloyed good. This is not universally believed to be so. Practical men sometimes say that it is too complicated to be useful, that analysts are more interested in exercising their analytical skills or merely adding to the sum of human knowledge than in helping to solve policy problems. These practical men are not always wrong. Other, more fundamental, criticisms of policy analysis, expressed most eloquently by Laurence Tribe,[4] are that policy analysis: (1) concentrates on tangible, quantifiable factors and ignores or depreciates the importance of intangible, unquantifiable ones; (2) leaves out of consideration altogether certain "fragile" values—e.g., ecological or esthetic concerns; (3) focuses on results and, in its search for common measures, ignores both the processes by which preferences and decisions are formed and significant qualitative differences among outcomes; (4) tends to operate within limits set by the interests and values of the clients; (5) in the effort to be objective, employs deceptively neutral and detached language in dealing with intensely moral issues; (6) artificially separates facts from values; and (7) tends to overlook distributional objectives in favor of efficiency objectives.

These criticisms clearly apply to bad analysis—i.e., to analysis that fails to possess the characteristics listed earlier. And much analysis is bad. But they excessively depreciate the value of analysis that is incomplete or partisan. For example, as Allen Carlin and Alain Enthoven have argued in our discussions, even a narrow analysis can sometimes make a powerful case that an unwise proposal is in fact a bad one (e.g., that a supersonic transport will not be economically viable). Such analyses are useful. The criticisms listed above do have validity, but they are most appropriately cited against the claim that analysis provides a rule for choice. Their relevance to the heuristic function, which I argue is the principal one for analysis, is less clear.

There does not seem to be serious disagreement about some of the characteristics of the kind of analysis that is needed. Proper analysis as proposed by Laurence Tribe, for example, would point

> . . . in the general direction of a subtler, more holistic, and more complex

> style of problem solving, undoubtedly involving several iterations between problem formulation and problem solution and relying at each stage on the careful articulation of a wide range of interrelated values and constraints through the development of several distinct "perspectives" on a given problem, each couched in an idiom true to its internal structure rather than translated into some "common denominator."[5]

I would add: "and which seeks to develop new action possibilities and new objectives that might be sought." But I think it should be recognized that a pluralistic political system in which the participants use the techniques of policy analysis—narrow and partisan though they may be—can approximate the holistic style Tribe advocates, although I would not claim that the observation of such an analytic marketplace at work is an everyday experience.

This view of analysis is, I believe, a helpful one in relation to our central concern—namely, the neglect of fragile, fuzzy, currently nonoperational values. It has often been observed that we have invented institutional means for the protection or representation of values that are systematically neglected. We have done this by passing laws to protect the rights of minorities or to require an environmental impact statement for projects; we have done it by setting up government agencies to promote arms control and disarmament or environmental protection or the interests of the poor. But the threshold for the passage of laws and the creation of new agencies is not low. It is fair to ask what analysis can do to help to improve on this situation.

One way is to study complex environmental phenomena and to try to identify unexpected consequences of private or public actions. Another is to explore some of the long-run consequences of the neglect of certain values, and to stimulate the collection of illustrative data. Many people who do not think much from day to day about the decline in the number of whales or black-footed ferrets, when presented with data and analyses that record their decline and predict their extinction, may come to feel that this is a problem about which something must be done. And because the political process sometimes leads politicians to search actively for causes that have not been preempted by others, it is sometimes possible to connect neglected interests with those looking for issues to promote. This is a kind of lottery and it is also a kind of market test; those values that cannot command the votes or capture the imagination of politicians or are not protected by constitutional guarantee will not do well. It is a challenge to analysts not only to do

the kind of substantive analysis they have traditionally done, but also to devise ways of describing fuzzy or neglected phenomena and to invent ways of injecting them into decision processes.

IV

One of the most urgent needs, in my view, is achieving much deeper knowledge of the nature of governmental processes than the conventional learning provides. Policy outcomes are strongly influenced by the missions and structure of Executive branch agencies and congressional committees. Initially structured by law, they have evolved through time and experience, and have been constrained by technology and influenced by interest groups. It is not much of an oversimplification to assert that each major bureaucratic entity—bureau, agency, department—comes to have a special character which dominates its behavior. For example, the Corps of Engineers and the Bureau of Reclamation do not have as objectives the avoidance of flood damage, improvements in the efficiency of transportation, or increases in electric power production, but rather the carrying out of large-scale construction projects which contribute to these ends. An alternative, such as use of the price mechanism to help achieve those goals, is not generally within the policy space available to these agencies.

This kind of constraint on instrumentalities might be thought to be less in the case of departments with broader missions, such as Justice, Defense, or State. To some extent this is so, but these departments consist of aggregations of organizational entities, each with its own limited perspective, and the behavior of the collective largely reflects the behavior of the constituent parts. Congress usually proceeds in a similarly constrained manner through the action of committees that occupy well marked out turfs. And members of these committees are often moved by concerns even more parochial than those of the agencies they oversee. How a problem is treated is therefore largely determined by which agency gets the action. How differently might the Tocks problem have been viewed if it had been initially defined principally as a recreation problem and preempted by the National Park Service as a Delaware Water Gap National Recreation Area project?

Both the definition of the problem and the range of admissible solutions differs according to which agency comes to have principal responsibility. Moreover, the probability is low in most arenas that the dominant problem definition will be seriously challenged by

other bureaucratic interests. The boundaries of territorial rights are well known and usually observed. Struggles do occur from time to time, but they are costly; and a taste for the quiet life leads agency heads usually to prefer private horse trades to public fights. Nongovernmental interests are much more likely to mount overt challenges, but they are usually less well entrenched legally, they are less well armed with analytic resources, and they often have less staying power.

Organizational behavior can also plausibly be associated with many of the observed shortcomings in analysis discussed earlier. Does the frequently observed failure of analyses to use choice criteria sensitively or to give adequate weight to qualitative factors reflect only or mainly the limitations of analytic techniques or of the analyst's values or training? I think not. One must also look to the organizational setting in which analysis is done. If the performance of bureaucrats and analysts is judged on the basis of certain numbers (and it often is), then these performance measures have a powerful incentive on behavior. It should not be surprising that importance is attached in analyses to dollar measures such as sales of timber from national forests or physical measures such as recreation-days if these criteria are of great importance within the organizations that dominate many environmental decisions.

Observing the powerful role of organizational interests suggests an area of inquiry that is almost totally neglected by policy analysts, whose work has been largely focused on improvements in the tools of analysis or on applying these tools to substantive problems. This is the systematic study of the behavior of the principal institutions that shape public choices, their perception of their central purposes, the rules by which they operate, their internal systems of incentives and controls, and the means by which they seek to influence their external environment. The resulting hypotheses about their behavior could then be used to predict the alternatives that might be suggested when policy issues arise and to predict outcomes of policy decisions.

Perhaps the greatest current need, a need that organization theorists and students of bureaucratic functioning have only begun to meet, is the systematic study of policy implementation. We often refer to "a policy decision" as the end point of the analytic process. But more often than not "a policy decision" is but one move in a continuing decision process. An authoritative decision or cluster of decisions (e.g., the passage of a law and the appropriation of funds) may be necessary for *something* to happen, but it is usually not enough to determine *what* will happen. The realm of administrative

discretion is usually large. This is as it should be, for the alternative of trying to legislate ever more detailed means as well as broader purposes would be worse.

Many important choices are made during implementation; but neither the choices made by people at a low level in the organizational hierarchy nor the consequences of their actions may be obvious to what is somewhat inaccurately called the "policy levels." And sometimes the "policy levels" have little incentive to find out what is actually going on. In short, analysts who do not understand the salient characteristics of the bureaucratic system responsible for carrying out any given policy alternative cannot predict with much confidence what actually would happen if that alternative were adopted. With the kind of organizational knowledge that only a few now possess and that none possesses as fully or deeply as desirable, analysts could help to design alternatives which would have a higher probability of achieving the predicted or desired results. They would also be in a position to propose organizational changes that would alter the incentives and therefore the behavior of the dominant institutions.

In sum, the study of implementation behavior in organizations is the study of instrumentalities for achieving social purposes. And those who believe that important social values are neglected need to exercise ingenuity in devising mechanisms for the representation of these values. If the Sierra Club, the Friends of the Earth, and the Environmental Protection Agency did not exist they would probably be invented. But many more inventions are still needed to promote values of the sort these groups embody. The encouragement and support of the type of policy analysis they perform—perhaps it should be called meta-policy analysis—should be high on the agenda of any national environmental research program.

V

It is important to consider what components a fully developed system of analytic organizations that was equipped to carry out a broad spectrum of policy-related studies on environmental questions would include. The following array would represent a well-developed capacity for handling the analytic aspects of environmental problems:

1. In-house government staffs to do staff analyses, to make use of the policy analysis of external researchers, and to stimulate and sponsor new outside research.

2. Laboratories—governmental and nongovernmental—working in a wide range of technical areas.
3. A for-profit analytical services industry.
4. Manufacturing industry that produces prototypes and production items.
5. Academic research on a wide range of basic and applied areas.
6. Broad, interdisciplinary, long term research programs carried out in one or more large nongovernmental research institutions.
7. Small special purpose research institutes that concentrate on specific problem areas such as wildlife preservation.
8. State or regional analytic organizations to do project analyses in depth.
9. An environmental research agency responsible for identifying and funding important gaps in the research and analysis carried out by the mission agencies.
10. A set of membership organizations, trade associations, and consumer oriented groups that engage in advocacy analysis.
11. One or more journals that regularly review major policy analysis on environmental questions.

Parts of this environmental-industrial-governmental complex already exist, and the supply of trained analysts is increasing. A recent development of potential importance is a Ford Foundation grant to Resources For the Future for a broader program of work that could permit RFF to become a major contributor to policy related analysis in the environmental field. If so, it would fill one of the more obvious institutional gaps—the absence of a broad environmental research institute of the type proposed a few years ago. The concept then was to create a private organization that contracted with government agencies to do both policy oriented research and related background studies. It was also to have had a significant amount of relatively unconstrained nongovernmental funding. Much of its work was to have been organized on a long term programmatic basis; but some would have been on near-term policy issues. The institute's program would have included systematic analysis of the generalized waste products problem, the theory of exploitation of depletable resources, land use problems, the technologies of pollution control, the use of market vs. nonmarket instruments, the study of behavior of organizations which affect the environment, and—not least—mechanisms by which environmental values might be effectively incorporated into public sector decision processes. This model is close to that of Rand; the major difference is that the proposed institute would have had a greater proportion of

nongovernmental foundation funding. The central feature of this model is that both work on policy issues *and* broad system studies would be carried out within one organization. Perhaps now RFF will become that organization.

The proposal for a gap-filling environmental research agency is based on the observation that the bureaucratic constraints of operational mission agencies inevitably cause important research and analytic questions to be overlooked. This institution's task would, therefore, be to sponsor work on important neglected topics. Its work would be done largely on contract with outside organizations because the areas of need would shift substantially over time. The institutional model here is ARPA, the Advanced Research Projects Agency of the Defense Department.

Small special purpose research organizations would have the advantages of the concentration, technical competency, and dedication that can be achieved through a focused effort in a specific area. Some possible missions for such special purpose institutes might be wildlife preservation, development of recreational opportunities, studies of land use (e.g., a Land Use Center has been established recently by the Urban Institute), wetlands preservation, and energy and materials conservation. These organizations could serve as sources of information by providing inputs to other project analyses, but most important, they would generate ideas to further their own missions.

State and regional analytic organizations could provide resources for project analyses and act as a counterbalance to the federal agencies which dominate project analyses now. These regional institutes might be financed by both federal and state funds.

There is, in addition, the important task of developing and maintaining professional standards, exposing shoddy work, and arranging to have analyses done from different perspectives meet head-on. The academic journals do this in scholarly fields. But this mechanism has not worked well in the field of policy analysis because the range of substantive areas covered is large, publication channels are varied, and the standards of performance are ill-defined. Disciplined, thorough review of major pieces of policy analysis is rare. A recent effort to review standards in one area suggests a reason why: the inquiry undertaken several years ago by the Operations Research Society of America (ORSA) into the analytic aspects of testimony on antiballistic missiles led to a useful review of some of the calculations that were used to support widely varying policy positions taken on the ABM.[6] But it also raised controversial questions about the proper role of professional organizations in

purporting to "police" the analytic and advisory activities of their own, and related, professionals. Therefore, groups like ORSA are unlikely to make this kind of inquiry a regular activity, and other means for carrying out careful review of major analytic and advisory products are needed. Fortunately, a new journal being started at the University of California (Berkeley) Graduate School of Public Policy has this as one of its stated purposes.

VI

Finally, it can hardly be doubted that environmental problems are among those most in need of, and ultimately susceptible to, systematic analysis. Many of them are enormously complex—so much so that counterintuitive consequences are often to be expected. After all, one of the basic concepts in ecology is the notion of the "system," with its complex interrelations and with the possibility of remote repercussions from current decisions. This is a field of endeavor that requires an enormously wide range of research: basic scientific investigation, methodological innovations, the forecasting of trends, specific policy studies, the investigation of decision processes, and devising means for bringing together the knowledge and skills of experts from many fields in close and continuing working arrangements. If this can be done, it is likely to have a very high payoff indeed.

But in the end, the work of the analyst must be supplemented by that of the artist, poet, and novelist. Policy analysis has its virtues, but the large changes in society are brought about through processes of which it now knows little—processes about which it can hope to learn a little more.

NOTES

1. For a similar view of preference formation and the role of analysis see James G. March, "The Technology of Foolishness," in *Civiløkonomen*, Copenhagen, vol. 18, May 1971, pp. 4–12. For an earlier statement see Albert Wohlstetter, "Analysis and Design Conflict Systems," in *Analysis for Military Decision*, ed. by E.S. Quade (Santa Monica, Calif.: Rand Corp., 1964). This essay was based on lectures given at Rand in 1954–55.

2. See the article by Mancur Olson in *Evaluation*, vol. 1, no. 2, 1973.

3. John D. Steinbruner, *The Cybernetic Theory of Decision—New Dimensions of Political Analysis* (Princeton, N.J.: Princeton University Press, 1974).

4. See Laurence Tribe, "Policy Science: Analysis or Ideology?" *Philosophy and Public Affairs* (Fall 1972): 66–110.

5. *Ibid.*, p. 107.
6. "Guidelines for the Practice of Operations Research," *Operations Research* 19, (5), (September 1971): 1123–1258.