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CHOOSING OUR ENVIRONMENT: CAN WE ANTICIPATE THE FUTURE?

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HEARING
BEFORE THE
PANEL ON
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OF THE
SUBCOMMITTEE ON
ENVIRONMENTAL POLLUTION
OF THE
COMMITTEE ON PUBLIC WORKS
UNITED STATES SENATE
NINETY-FOURTH CONGRESS
FIRST SESSION

DECEMBER 15, 1975

PART 1
FUTURES ANALYSIS AND THE ENVIRONMENT

SERIAL NO. 94–H31

Printed for the use of the Committee on Public Works

AUTHENTICATED
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CHOOSING OUR ENVIRONMENT: CAN WE ANTICIPATE THE FUTURE?

Futures Analysis and the Environment

MONDAY, DECEMBER 15, 1975

U.S. SENATE,
COMMITTEE ON PUBLIC WORKS,
SUBCOMMITTEE ON ENVIRONMENTAL POLLUTION,
PANEL ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY,
Washington, D.C.

The panel met at 11:30 a.m., pursuant to call, in room 4200, Dirksen Senate Office Building, Hon. John Culver (chairman of the panel) presiding.

OPENING STATEMENT OF HON. JOHN C. CULVER, U.S. SENATOR FROM THE STATE OF IOWA

Senator CULVER. The hearing will come to order.

I wish to take this opportunity to welcome you this morning to the first hearing by the Panel on Environmental Science and Technology [PEST] of the Senate Environmental Pollution Subcommittee in the 94th Congress.

This hearing is the initial hearing in what is projected to be a year-long series of hearings entitled: "Choosing Our Environment: Can We Anticipate the Future?"

The Panel on Environmental Science and Technology is a unique subcommittee well suited for the examination we are about to begin. It was established in 1971 as a panel of the Environmental Pollution Subcommittee, and it is designed to be a study and factfinding body rather than a legislative one.

Its purpose is to focus attention on research regarding the science and technology of the control of the environment. I am confident that the information developed by the panel in these hearings as in the past, will be usefully meshed into the legislative process.

I have had a longstanding interest in the compelling need for effective capability in forecasting and futures analysis in public policy. It is readily apparent that we are living in an era of finite resources, accelerated change, increasing complexity, and growing interdependence.

In many ways our public decisions today have perhaps more long-range consequences than ever before. Often the outcome of the decisions made today will be felt only after an interval of several years.

Recent energy and environmental problems demonstrate that as a Nation we are reacting to problems rather than anticipating them before they grow into national emergencies. For instance, environmental degradation offers a classic case of government by crisis. We had no idea several years ago that our form of industrialization and urbanization would have such an adverse environmental impact. Now we are frantically trying to recover what we failed to foresee.

As a consequence of these major crises that have come upon our society from the blind side, I believe there is a growing sense among the public that its institutions are rudderless. This feeling of drifting has one hopeful consequence in stirring an awareness of the need for better long-range planning and effective consideration of policy alternatives. People are now seeking the answers to certain highly meaningful questions.

Are our public institutions adequately equipped to handle the future? How can we improve our capability to foresee emerging problems before they become full-fledged emergencies? What kind of future do we want?

This series of periodic hearings by this panel over the next year will address these questions. Briefly, they will provide a forum for exploring the possibilities for more effective futures analysis and forecasting in American government and society.

They will, I believe, help to identify emerging issues of interest to the Subcommittee on Environmental Pollution and will explain how the potentials of futures analysis can improve public policy analysis.

With this objective in mind, subsequent hearings will consider the future development and impact on the environment of such major considerations as growth, energy, and natural resources, and the quality of life. We will also study the relation between forecasting and the decisionmaking process, including an analysis of the role of the citizen in the planning process, the foresight capacity of the Environmental Protection Agency, and specific institutional changes that would be required to give Congress a strong capability for forecasting.

Today's hearing, "Futures Analysis and the Environment," will introduce us to the general subject of futures analysis. It will lay a broad foundation for the subsequent hearings by discussing the need for the capability of forecasting, the major difficulties facing government today, the experience of the private sector with foresight provisions, and the effectiveness of planning and forecasting in choosing our environment.

The distinguished group of witnesses before us is well qualified to address these issues, and I believe what they have to say will provide a stimulating overview as well as setting a foundation for our future inquiries. Hopefully, their comments will help us to improve our capacity to govern more effectively.

This morning our first witness is Mr. Alvin Toffler, who is associated with the Committee on Anticipatory Democracy. He is the author of the best-selling book *Future Shock* and also *The Eco-Spasm Report* and the originator of the concept of "anticipatory democracy."

I am very happy to welcome you here this morning, Mr. Toffler, and I am grateful for the fact that you have prepared a statement. In order to permit us to have an interchange of questions and answers

later in this hearing, I would appreciate it if each witness would limit his summary of the prepared remarks to 15 minutes. The entire text will be made a part of the record of the hearing.

Mr. Toffler, would you please begin?

STATEMENT OF ALVIN TOFFLER, COMMITTEE ON ANTICIPATORY DEMOCRACY

Mr. TOFFLER. Senator, thanks for inviting us here to discuss what I think most of us in the room, or at least at this table, regard as a highly significant public policy question, which has not received sufficient attention.

Some people plan, others are planned upon. Some governments plan, others are planned upon.

The American future is being stolen, dribbled, and bumbled away by a government that does not plan for the long range, does not know how to plan, is afraid to talk about the need for long-range planning—and is therefore outplanned at every step by major corporations who are staking our pieces of the future for themselves, as well as by foreign nations who are doing the same on a global scale.

Failure to look at America's current economic and political crisis in terms of the next 25 to 50 years is costing us unmeasurable billions of dollars in lost economic and social opportunities, and is leading us toward technological and military policies that could threaten the survival of the entire planet.

The United States, in order to avoid bloodshed over the next few decades, must begin now to develop very long-range strategies—and must invent wholly new forms of planning that involve not merely a handful of technocratic experts, but millions of ordinary citizens. We must become an "anticipatory democracy."

THE SUPERINDUSTRIAL REVOLUTION

A dramatically new approach to the future is now required because the United States—along with other technological nations—has reached the end of its industrial stage and is about to move into its superindustrial stage of development. Economic strategies, business plans, social policies designed for an industrial society are no longer effective. Old economic theories like Keynesianism or traditional "laissez faireism" or "socialism" are all obsolete in this new situation. We are entering into the superindustrial revolution—a transition that may bring changes even deeper than those brought by the industrial revolution itself. And it is likely that these high-powered changes will be compressed into decades instead of centuries.

Industrialism was a world system based on: cheap raw materials; nonrenewable fossil fuel energy; electromechanical technologies; nuclear family system; mass education; mass communication; high urban concentrations; a predominance of employment in the manufacturing sector, and materialist values and growth ethic.

Today massive changes are occurring at very high speeds in resource prices, the world energy system, and the very nature of technology. We are beginning a shift from the old electromechanical technologies typical of industrialism, such as rail, auto, steel, or

rubber production, to new industries such as aerospace, petrochemicals, electronics and, eventually, to ocean mining, new forms of agriculture, and industries based on molecular biology. In the family system we are witnessing a radical shift away from the nuclear family as the standard model in society. Even now one out of seven American children is raised in a single parent household; one out of four in the urban areas. More and more "aggregate families" are cropping up composed of intertwined members from several divorces. Homosexuality is gradually assuming a more open role in the society. Our cities are becoming worn out and losing their economic base. The proportions of the work force engaged in service and other nonmanufacturing functions has risen. We are moving away from simple-minded, unidimensional growth policies toward a broader acceptance of the idea of "balanced growth"—ecologically and socially responsible growth.

All these taken together are parts of a worldwide transformation, and similar changes are being felt in most of the industrial nations, not merely the United States. What is happening is the emergence of a new stage of technological civilization, a superindustrial stage. This transition could take from 20 to 50 years, at a guess, and it could, unless understood and planned for, result in extreme turbulence—wars, insurrections, secessionist movements, riots, revolutions, technological disasters, ecological catastrophes, military outbreaks, nuclear accidents, and the like.

The industrial revolution, which occurred on a much smaller scale and at much slower and more easily absorbed rates of change, was accompanied similarly by massive shifts in population, starvation, civil wars in many countries—including our own—the breakup of the old family structures, and tremendous geopolitical changes on the face of the Earth. It was also accompanied by a period of "grand imperialism" that underwrote economic development in the West by exploiting the people and raw materials of the rest of the world, at the cost of many wars.

If we want to make the transition to superindustrialism a peaceful one, we must begin now to plan for it—to lay out long-term democratic strategies that will help us completely overhaul our industry, reconstruct our cities, reshape our family system, create a new more rational energy base, deescalate our military expenditures and the dangers of global nuclear confrontation, and to rethink our community structures.

Faced by changes of such overpowering magnitude, the failure to engage in futurism, the failure to plan ahead, the attempt to deal with legislative and other policy issues on a purely ad hoc basis, the failure of any administration to putf orward a positive image of America 2000, all result in decisions that are self-canceling, wasteful, and ineffective. The result is a radical loss of public confidence in government, mounting disillusionment, cynicism, and anger. The potentials are in place for the current passivity, even paralysis, to explode into violence.

Is there anything we can do about this, and does futurism have a contribution to make? The answer, on both scores, is "Yes."

It is not possible for anyone to come up with a neat, effective, master plan for America's future, and if anyone tried, it would be either

farcical or dangerous. Social change on so vast a scale is not neat; it is messy. It cannot be easily controlled by a handful of experts or politicians, fortunately. It is a process that occurs at a million points at once—in schools, in businesses, in churches and community centers, as well as in government, and it involves millions of ordinary people, as well as specialized elites. Nevertheless, futurism can make a significant contribution to our coping with and understanding the situation.

WHAT FUTURISTS CAN DO

Futurism and futurists are not like the men in white coats in television commercials. They have no miracle cures. And no one, no matter how refined the methods used or awesome the charts and diagrams, knows what the future will hold. There is no such thing as "prediction" in any absolute sense. The best forecast should be taken with more than the usual grain of doubt.

What futurists can help do, however, is to identify new policy options that normally are overlooked. They can detect important variables in a situation that, once again, may otherwise be neglected. They can assign probabilities to various future events and change those probability rankings as changes occur (recognizing, however, that these probabilities are, as a rule, nothing more than systematized intuition). They can provide early warning services for the environment, the economy, the society—tipping us off in advance to the possibility of crisis. They can spot new opportunities; not only in technology, but in foreign relations, social and community development and other fields. They can help bring coherence to policies that might otherwise be scattered, spotty and self-canceling.

But they serve another function as well. Simply by focusing public attention on the longer range options and problems that face us, they help bring about an educational and cultural change in the country which transforms into a political change—a change in the voters, if you will, that encourages them, too, to think in longer frames of reference. Since many of our problems are very long term problems, and are not susceptible to instant solutions, futurism generally raises the entire level of political debate as well as policy analysis. Futurists can help us shape intelligent, coherent strategies for making the transition to the next stage of American society.

THE DIVERSITY OF FUTURISM

Futurism is not a thing, let alone one thing.

Futurism, at one level, is a discipline, although, unlike other disciplines, it is multidisciplinary and involves not merely economics, but religion, not merely psychology but physics, biology and sociology and systems engineering and aesthetics, not to mention political science, anthropology, and history. As a discipline, it makes use of certain specialized methods. It has begun, alas, to develop its own jargon, and it has its own heroes and villains, its own internal pecking order.

But futurism is also an attitude—a perspective toward change. And at this level it is not the property of a specialized academic priesthood. In this sense, it is a posture toward the world that take rapid change for granted and attempts to anticipate and influence its

effects. Many a housewife, taxi driver, or farmer has a futurist perspective, a concern for the future matched by a willingness to do something about it.

Futurists, moreover, come in many styles. There are today many thousands of Americans—and, of course, tens of thousands of people all over the world in other countries—who are engaged in the professional study of the future, or who are teaching about it. They can be categorized in various ways:

First: There are the three P's. Some futurists are most deeply concerned with forecasting the most probable future. Whether in think tanks or universities or corporate offices or Government agencies, they basically see themselves as analysts and they try to determine in advance what will "probably" happen. They work on the "probable" future.

Next, there are those who are more concerned with what is possible than what is probable. They believe that we use insufficient imagination in our political decisionmaking and in other spheres of life, and they try to imagine alternative futures, new hitherto unexplored scenarios. They are primarily concerned with "possible" futures.

Then, there are those who are interested in both the possible and the probable, but are primarily concerned with the preferable. They may be political leaders or clergymen, individual citizen activists businessmen or social critics. They want to bring about certain changes they regard as desirable. They work on the "preferable."

Needless to say, these three different dimensions are not as neatly separable as this, they are interwoven and most futurists, although they may emphasize one or another dimension, deal with all three. If Congress is going to make use of futurists, it may be helpful to bear these distinctions in mind.

Second: Another way of classifying futurists has to do with their values. Some regard themselves much as scientists and technicians used to—as morally, politically, and emotionally neutral. They usually present their findings in highly mathematical form, filled with tables, graphs, and other complex displays. Others make no secret of their values, and even attempt to make them explicit. They take the position that no work—least of all something as politically loaded as planning or forecasting—can possibly be neutral. A good question for Congress to ask in approaching the findings put forward by futurists—as it does on other occasions—is "Who funded the research?" "Whose interests are served?" "What variable has been singled out for special attention?" "By whom and how was it weighted?" I confess that in my own view, all futurism, like all journalism or all science, for that matter is, in fact, ultimately political. None of it is truly "value-free."

In saying this, however, it should be noted that many futurists are not political in the traditional sense. They tend to regard both parties as obsolete or backward-oriented, and some believe that politics as a whole is a dying industry not worth spending much time on. So, in saying that futurists are political, I mean only that their work has potential political impact, even when they are at pains to be apolitical.

Third: One more way of classifying futurists—and, in my view, one of the most important—has to do with how they view change. Some futurists—and many planners—really do not believe in change.

When we look beneath their testimony, we find a very simple statement: Whatever exists will continue; only more so.

These futurists are known in the trade as "extrapolationists" or linear thinkers. They say that because America is the richest country, it will continue to be the richest country. Because we have have grown economically for 100 years, we will grow for another 100. Because most work is boring, most work will continue to be boring. Because most people live in nuclear families, most people will continue to live in nuclear families. These futurists, however brilliant and imposing they may be, are simply telling us that the changes ahead are not terribly important.

Linear extrapolation, otherwise known as straight-line thinking, is extremely useful, and it can tell us many important things. But it works best between revolutionary periods, not in them.

Thus there is an entire group of futurists who start from what I call a "revolutionary premise"—not revolutionary in a traditional political sense, but in the sense that they see our moment of history as revolutionary. They believe that we are moving into a new stage of technological, economic, and social history, in which the ground rules of the old system no longer will apply. They, therefore, are very cautious about making straight line projections. They look forward not to steady, linear growth or development in America, but a period of upheaval, trauma, upset, reversals, and leaps. From my opening remarks, it should be clear that I place myself in this group. I believe we are at the edge of the most revolutionary changes in American history, that we are faced with the need to create a new future for this country. I would urge the Senate, in assessing the testimony of others as well, to ask whether that testimony flows from straight-line thinking or from the nonlinear view. Are we moving into a period of sustained, regular, steady, predictable growth along the same lines of the past century or two, or are we likely to face extremely rapid and profound upsets of one kind or another in the years ahead? If you can get your witness—futurist or not—to state his or her assumptions about that question, you will have a better basis for evaluating what follows.

Fourth: Futurists can also be classified according to their attitudes toward numbers and people. Some futurists essentially attempt to apply the techniques of the physical sciences to their study of the emerging future. They place great reliance on systematic methodology. They create careful—and not-so-careful—models of the economy or of an industry or of the international arena. They conduct systematic surveys of expert opinion. They tend to be made uncomfortable by data that cannot easily be quantified. They therefore frequently, though not always, neglect political considerations, values, social forces, ethical or religious or cultural factors in their analysis. They are essentially "technocrats."

By contrast, there are those who are mainly concerned with the "soft"—that is, not readily quantifiable—realities. They are interested in the future of love, God, the family, or even states of consciousness. They tend to resist numbers as alien, and to regard the technocrats as cold, mechanical, and inhumane. They are less concerned with systematic inquiry, less interested in models and surveys, and simulations, and more concerned with quality of life or the quality of human relationships. They call themselves "humanists."

It is fair to say that there is a good bit of nonsense in both camps; pseudoscientific hocus-pocus in one and pseudoreligious or mystical hocus-pocus in the other. Fortunately, there are technocratically inclined futurists who recognize the severe limits of their tools, and are ready to fuse their findings with nonquantified research, along with plenty of concern for humaneness and quality of life, just as there are humanists who know more than a little about numbers, computers, complex models and simulation exercises.

Fifth: Of course, another way to distinguish futurists is determined what time frame they operate in. Many planners who claim to be futurists concern themselves only with the immediate future, the next 6 months or 2 or 3 years. Increasingly, 5- and 10-year horizons are required in both the public and private sector. The new congressional budget procedures, for example, require projections to be made for a 10-year period.

Most futurists, however, regard even a 10- or 15-year horizon as essentially the short range, and many focus on a 25-year time frame, give or take a half decade. A few concern themselves with even longer range problems and possibilities running out as far even as a century or more. Before an intelligent conversation with a futurist can begin, the time horizon needs to be specified.

Sixth: Finally, one may classify futurists as either elitists or participationists—and this brings us full circle back to where I began when I referred to our becoming an "anticipatory democracy." American society never went through the feudal period that so marked European and Japanese culture. We never had a very important hereditary class of aristocrats. We prided ourselves from the first on our being a country "of, by, and for the people."

POPULISTS VERSUS BUREAUCRATS: A FALSE SPLIT

Today a basic split is emerging in American political life which is reflected, in a small way, among futurists as well, over the role of "The People" in making decisions about America's future. On one side are those who say that society has become so complicated no ordinary citizen, no worker or farmer or housewife can be trusted to make a sensible decision about the kinds of issues that daily confront the Government. They say that we must permit these decisions to be made by experts, or by political leaders advised by experts. They believe that planning—if it should be done at all by government—should be the work of men and women equipped with Ph. D.'s and capable of dealing with input/output coefficients and cross impact matrices. The future, in this view, is too important to be left to the people.

This view is countered today by a growing anti-intellectualism and antiexpertism that is reflected in several important and powerful political movements in the country. Various candidates can be heard inveighing against "pointy headed bureaucrats" and everywhere people feel they have been let down or betrayed by specialists, experts, academics, civil servants, and, above all, the politicians who hire them. Of course, this attitude is expressed in both parties, and at all levels of politics from the local to the national. This attitude is sometimes—and I believe wrongly—termed "populism."

Who is right? Is government so complex that the people can no longer be expected to play a significant role? Should we simply stop bothering with the farce of elections and turn the keys over to a group of elites and the planners they bring with them? Or can we, by contrast, get rid of all the complexity and return the country to the people by moving America back to an earlier, simpler form?

I would argue strongly that there is no going back; no return to any earlier period. America is going to change dramatically, whether we want it to or not because the entire world outside, on which we are extremely dependent, is also changing. The planet itself is changing; its climate, its oceans, its forests and rivers, not to mention of course its human population. The hidden subsidy that all industrial nations, not merely the United States, received from fossil fuels and cheap raw materials, is being withdrawn. Moreover, the American people, themselves, are changing socially, politically, morally, and educationally. No new administration, whether of the mainstream or of the Reagan-Wallace variety, can make change stop.

If we are to cope with these massive, indeed earth-shaking shifts and changes in the years ahead, we will need something new: A new fusion of expertise with democratic social control, a combination of specialists with their ability to see deep into a problem, and of ordinary citizens, with their skepticism and ability to see around the outer edges of problems.

What we will need is planning; but of a kind no nation has as yet used. Planning that is not the work of central office bureaucrats, with their master plans and their ignorance of the microdetails of everyday life. Planning that is not top down. Planning that does not stifle the originality, energy, intelligence, and innovative drive of ordinary people, but rather incorporates those qualities.

Until now the only examples of government planning we have seen have been, by and large, elitist, technocratic, arrogant and dangerous. Apart from which, they have not even been successful examples.

ANTICIPATORY DEMOCRACY—A NEW KIND OF PLANNING

In the United States today the future is being planned. It is being planned in a piecemeal, narrow and overly econocentric fashion by the major corporations who long ago recognized the need to look forward and develop strategies for change. Outside the United States, the future is being planned by governments in many countries, both Capitalist and Communist, from Sweden and Japan and Germany to France, the Soviet Union and Yugoslavia. The future is being planned by governments in Iran, and Saudi Arabia, Kuwait and Libya. The future is being planned in China and in Norway.

Governments and vast multinational corporations are each staking out their piece of the future, determining their "preferable future" and a set of strategies for achieving it. Meanwhile, the United States refuses to take responsibility for planning by the public sector.

Our hesitation is not without reason. Having seen how governments elsewhere have planned or are planning, we recognize that there are serious dangers in the planning process. We need only to look around to see that in most cases the planning we have seen has tended to centralize power, to create vast new bureaucracies, to interfere with the self-regulating capacity of market economies, to create new elites of planners. What is more, we see that central planning often amplifies

error, rather than eliminates it. We have learned that bringing the best brainpower together with computers and sophisticated models is no guarantee that the goals pursued will be either sensible or democratic. We have also seen, at its worst, the ways in which centralized, top-down economic planning of the type characteristic in industrial societies has gone hand in hand with totalitarian politics.

None of this, however, means that we can proceed as we have been doing. We are not trapped between planless democracy on the one hand, or planned tyranny on the other. This either-or dichotomy is a false one. For, as futurists often emphasize, we have many unexamined alternatives available to us. One of these alternatives is to use our political will and creative abilities to invent a completely new kind of planning—planning attuned not to the centralist, bureaucratic needs of industrial society, but to a decentralist, participatory super-industrial society, planning that involves ordinary people in setting the goals of the system.

I would urge this Senate, therefore, to recognize that the transition from a dying industrial America to a renewed, stable, sane, and decent America of the future—America 2000, if you will—will require strategic planning of a totally different kind. The planning office in the State of Washington, in conducting a fascinating experiment in citizens' futurism, adopted as its slogan, "You don't have to be an expert to know what you want." The determination of long-range goals should not be left to any small group.

I would urge this panel to investigate the experiment in participatory futurism that flowed from that slogan in Washington State last year. I urge you to look into the work of Iowa 2000, and of Hawaii 2000, and the various statewide and local activities that have sprung from it. I would urge you to take as a priority for the coming year in the Senate passage of a National Participation Act that will help fund, study, evaluate, and promote these citywide, statewide, and regionwide experiments with citizens' futurism—experiments that seek to combine, in the healthiest way, the knowledge, talents, and skill of experts and futurists, with the commonsense, skepticism, and vision of tens upon tens of thousands, perhaps hundreds of thousands of American citizens.

Anticipatory democracy is the only kind of democracy possible in a period of high speed social, technological, and political change. Failure to anticipate will lead to tragedy in America. By the same token, long-range thinking that is unconnected to the ideas, energy, and imagination of our whole population, long-range thinking that is merely top down, and not equally bottom up, could also produce the end of democracy. It is only by combining long-range strategies for tomorrow with the involvement of millions in formulating goals that we can assure that there will be an America 2000.

Senator CULVER. Thank you very much, Mr. Toffler, for an extremely provocative statement.

[Mr. Toffler supplied the following responses to additional questions:]

QUESTIONS SUPPLIED TO MR. TOFFLER

Question 1. You have spoken of the need for anticipatory democracy and decentalized citizen participation in the planning process. How should such participation be structured? How could the Congress facilitate such participation?

Response to question 1. There is no single right way to structure citizen participation. We are still at an early stage in learning how to do it effectively. We will need to experiment with and evaluate a variety of models. Congress can facilitate such experimentation in several ways.

First, an analysis should be made—perhaps by the CRS (Congressional Research Service)—of all existing legislation that requires citizen participation. A great many statutes already on the books do so. They affect health services, community development, social security, and other activities. We need to know exactly what is mandated.

Second, we need to evaluate these efforts and determine what support can be provided to make them a success. For example, legislation now before Congress proposes to establish local planning councils to help deal with unemployment. But no provision is made to train local participants, or to supply the kind of think tank and university services to them that are routinely available to coroporate planners. No program exists for involving the entire no-profit sector in upgrading its own planning efforts and finding ways for it to feed into the citizen participation efforts called for by law.

Third, Congress should similarly evaluate the efforts of A/D (Anticipatory Democracy) organizations now spreading across the country—various state and local "2000's" and other citizen participation efforts. These are an excellent source of alternative models. Some of these are part of the official state or local governmental structure; others are private voluntary efforts.

Fourth, Congress should provide incentives to states and cities to develop their participatory planning efforts, helping to transform them from "one-shot" activities into on-going processes.

Fifth, Congress should, as part of the general revenue sharing legislation, require that recipients allocate a small fraction of the funds to planning so that the remaining funds could be most intelligently applied. This provision should require that the planning process be open to broad citizen participation and that it concern itself with 5 to 15-year consequences of proposed programs.

Question 2. Since we have never had democracy in the ideal sense, why do you believe that we will be able to move toward greater citizen participation in planning?

Response to question 2. There are, of course, many problems with the concept of participation. How to define constitutencies. Who is to participate in which decisions. The fact that traditional methods widen middle class participation, but hold little appeal for the poor, ethnic minorities, the elderly and other groups. The relationship between expertise and goal-setting. All these present real difficulties. So any notion that participation or A/D will produce an ideal democracy needs to be dispelled. Nevertheless, the growing pressures for anticipatory democracy represent an important development in the American political system. Faced with absolute fundamental shifts in the geopolitics of the planet, in technology, social institutions and values, we need to redefine the American dream. This cannot be done in any meaningful way by tiny, specialized elites. It can only be done through a long process in which millions participate, grappling with their own values and the long-term consequences of their own decisions.

Question 3. As a means of illustrating anticipatory democracy, which environmental issues require the attention of the expert and which should be handled by the citizen?

Response to question 3. Environmental issues offer a perfect example of problems which can be solved by merging high expertise and popular participation. In Sweden, for example, the national government, in trying to define an intelligent, long-term policy, involved some 70–80,000 citizens, through several political parties and through various adult education activities, in a formal discussion of energy options, then surveyed *their* suggestions for policy. (On the American scale, this would be the equivalent of involving approximately 1,500,000 people). The results of this exercise was a perceptible shift in public sentiment and, I believe, in government policy with respect to nuclear energy.

There is no reason why Congress could not authorize similar programs on topics such as transportation, food, pollution trade-offs, and the like. Such programs could be organized with the help of our adult education system, churches, trade unions and other community organizations.

Question 4. What should be done to change the rewards structure of the political process to remove resistance to futures analysis in public policy analysis?

Response to question 4. There are certain built-in features of American political life that tend to restrict our terms of reference to the immediate. Short terms of office, for example, mitigate against long-range thinking, although the resvrse—long terms of office—have other ill effects. Short of fundamental Constitutional revision, the time frame of government will grow longer only when the public in general grows more future-conscious. This is why it is so important to establish anticipatory democracy as a central process at the state and local levels. It will free political decision-makers to deal with the future more intelligently.

Question 5. At the Second General Assembly of the World Future Society, you stated that our conventional models and stabilizers are totally obsolete and not equipped to handle the crisis of the superindustrial society. What other particular kinds of models can deal better with the problems of the superindustrial society?

Response to question 5. Answering this would require a fairly long philosophical discussion. I'll pass on this for now.

Senator CULVER. Our next witness is Mr. Theodore Gordon. Mr. Gordon is president of the Futures Group, Glastonbury, Conn., which is an independent consulting firm providing futures-oriented services. Formerly, he was vice president of the Institute for the Future and director of advanced space systems for McDonnel-Douglas.

Mr. Gordon, it is a pleasure to welcome you to the panel this morning. You may proceed with a summary of your prepared statement.

STATEMENT OF THEODORE J. GORDON, PRESIDENT, THE FUTURES GROUP

Mr. GORDON. Thank you, Senator Culver. I will not read my statement but give a summary of it. [The complete statement appears at p. 21.]

I appreciate your invitation to express my views on planning and environmental analysis to the subcommittee.

I have been asked to address four specific questions this morning and I am pleased to appear here to respond. The questions deal with institutions performing futures analysis of the environment, effectiveness of their tools; resistance to this work; and how it may help us in choosing our future environment.

These questions are particularly appropriate at this time. There is a growing appreciation that—with some important limitations—futures analysis is possible and necessary, and that planning at all levels is one of the most useful kinds of action now available to a society interested in protecting its future environment.

Furthermore, the environment, particularly viewed on a global scale, is likely to be under unprecedented strains in the years to come.

Before addressing the four specific questions posed by the subcommittee, I would like to illustrate how futures planning and the environment intersect by discussing two extremely important environmental issues which will certainly have significance for the United States in the immediate future.

These issues, it seems to me, typify areas in which futures research and planning are essential. They are raw materials availability and world food supply.

While it does not appear that economically useful desposits of any major mineral resource will be depleted on a worldwide basis in this century, the drive for increased economic output on the part of essentially all nations, and the pressures created by a growing world population, will certainly require continually expanding raw material use.

This will almost certainly result in increased competition on the world market, rising prices, inflation and, with respect to the U.S. environment, great economic and strategic pressures to develop currently marginal mineral resources in the Western portion of the United States.

Developing our current marginal indigenous resources would, however, have significant environmental and political ramifications. Politically, we already hear dissatisfaction expressed by a State, rich in one or another mineral, which feels exploited when it must export that mineral, at the expense of its environment, to satisfy the needs of another State.

With respect to the primary environmental consequences, land use problems—particularly questions centering around the use of Federal lands—would certainly arise. In addition, availability of water and disposal of solid wastes residuals of the mining process would be of great concern.

Futures analysis and planning provide a means for exploring the significance of these issues, their timing, and alternative approaches to their solution. Effective planning would include consideration of substitute materials, means for improving efficiency in the use of materials most likely to be in short supply in the future, use of by-product and waste material, improved mining processes, and various approaches to recycling.

This list is certainly not complete, but it illustrates some areas in which cohesive planning and anticipatory action might make a difference. To wait and hope for large-scale value changes which would result in reduced economic growth and consumption is, in my view, unrealistic: The system inertia is too high; the lessons of the culture, too strong; and the levels of expectation too high in the United States and elsewhere.

A second example, one of perhaps even greater importance, which illustrates the need for futures analysis and planning in the environmental area is the potential for world food shortages. That world population growth rate may exceed the rate of increase of agricultural production is well known. The trends which suggest that food will be in short supply include:

Continuing growth of world population, concentration of this growth in developing countries, effect of increased energy prices on highly developed agricultures, costs of new technologies to increase output, concentration of exportable surpluses in North America, lack of any appreciable grain store either in the form of unplanted land or harvested grain in the world, increasing competition for exports on the world market, and in many countries inadequate infrastructure affecting distribution efficiency.

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Agriculture is basically a polluting enterprise. When people are in need of food, preservation of the environment will certainly be a secondary consideration. Pesticides, insecticides, and fertilizer contribute to both food production and pollution.

As the amount of land under cultivation increases, top soil is eroded, washed into the sea and lifted into the atmosphere. The increasing level of particulate matter in the atmosphere could affect the Earth's climate through increasing albedo, the reflectivity of the atmosphere.

The real confrontation between food and the environment is yet to come. As I said, when people are in dire need of food, preservation of the environment will certainly be of second priority.

These two examples illustrate the intersection among futures analysis, planning, and the environment. While many other examples could be added to the list, I chose these global issues because of their overwhelming significance to our country. Both problems illustrate that the environment, or indeed, almost any modern problem area, crosses disciplinary and geographical bounds, and involves systemic considerations of great complexity.

Nevertheless, I believe that action based on planning is possible and necessary in addressing such problems to avoid future situations which are apt to be disastrous otherwise. I hold this belief despite the fact that futures analysis is an incomplete and imperfect guide to the future, and that planning carries with it the risks of error and elitism, which I will discuss in a moment.

Now, let me turn to the questions posed by the subcommittee.

Question 1: What institutions are available, within or outside of government, for futures analysis of the environment?

Well, the number of organizations which contribute to or perform futures analysis of some sort is very large. There is, of course, no accurate census, but using several published directories and sampling the opinion of several of my colleagues, I am led to think that currently in the United States there are about 10 or 15 journals and newsletters which deal regularly with futures topics and perhaps another 100 or so that have periodic or occasional articles about the field; 30 to 50 active public participatory organizations known as Year 2000 groups concerned with future issues and opportunities in regions, States, and cities; 100 independent organizations—either profit or nonprofit—which perform futures analyses of some aspect of the environment, either full time or part time; 150 groups which are part of larger organizations, for example, long-range planning departments of corporations, which engage in this activity; and 300 to 400 university courses dealing with futures from either a substantive or methodological viewpoint, and uncountable high school courses.

To give another perspection to the size of the field, at the Futures Group we have been systematically scanning publications over the past 4½ years to establish a file of published forecasts of future events.

Over this period an average of two readers have been assigned almost continually. They review professional journals, trade publications, the popular press, and other sources. So far, this scanning has produced approximately 50,000 entries derived from over 5,000 sources and we are adding forecasts at the rate of about 200 per week.

Organizations performing futures analyses may be classed by organizational form: profit or nonprofit; public or private; inde-

pendent or affiliated; and full time or part time or by the type of work primarily performed, substantive research, including policy analysis, forecasting, and technology assessment; publishing of futures-related information; education in the futures field; and management consulting in planning and futures research.

Private organizations such as the Futures Group perform futures research full time for government and private clients. Over the past 4½ years our organization has worked for over 250 government and private clients. Large research organizations, such as Arthur D. Little, Battelle Memorial Institute, and Stanford Research Institute, also perform futures research, in addition to their other work.

Chase Econometric Associates and Data Resources develop products; computer economic forecasting models and data for sale to online clients.

Some architectural and engineering firms have performed technology assessments.

Many corporations have planning or futures research groups and, in government, many organizations use forecasting and policy analysis, including FAA, NASA, EPA, DOD, CIA, Congressional Budget Office, Office of Technology Assessment, USDA, Federal Judicial Center, and GAO.

Question 2: How effective are the tools for futures analysis of the environment?

The methods of futures analysis—and there are many—are both qualitative and quantitative. The qualitative approaches include techniques for collecting and refining expert judgment about future developments through questionnaires, interviews, interactive computer conferencing, and simulation gaming, and participatory approaches involving public debates about desirable future states of affairs and future threats through polling, town meetings, and interaction through TV, radio, and newspaper media.

The quantitative approaches include a variety of mathematical techniques for extrapolating historical data and model building. These can be used to form scenarios and probabilistic descriptions of future conditions.

No matter what methods are used in forecasting, there are some important limitations which must be recognized.

Forecasting can be only partially accurate. In forecasting future technological events, a batting average of two-thirds correct over a period of 10 years or so is to be expected. Social and value forecasts are probably less accurate.

Forecasts of environmental change will omit developments which, in retrospect, will seem important. Some of these omissions are inevitable since a component of the future is essentially unknowable—not just unknown, but intrinsically hidden from discovery.

Such developments are discontinuities of thought; mutations.

Value issues are of great significance, but difficult to resolve. A distinction should be made, for example, between a desirable future and a likely future. Too often, during forecasting, one is tempted to believe that a desirable situation is more probable, and a situation which appears distasteful, less probable.

Values change with time. Some circumstances which seem disastrous to us might be useful, natural, and beautiful to some future

society. When values change, and they must, how can planners judge what will be desired?

Almost all of the methods of futures analysis involve futures research of historical data. Inevitably, the assumption that the future will look like the past will be incorrect. Forces in the future will be different than in the past and these unprecedented forces will change the trends.

The essence of futures research is the identification, analysis, and incorporation of such unprecedented developments into trend extrapolation and at the Futures Group, this constitutes the frontier of our methodological developmental work.

In my written paper, I presented a half dozen or so examples of instances in which futures analysis has been important in environmental planning. The list is very incomplete, but it serves to indicate that futures analysis is being used in the identification and evaluation of the environmental options. How effective are these techniques? At the very least, they broaden the perspective of policy analysis by providing a means of inquiring about: Secondary and tertiary consequences of contemplated actions; noneconomic costs and benefits of policies; effects of actions on various interest groups; and sensitivity of the outcome of proposed policies to various external developments.

Question 3: Is there resistance to futures analysis and long-range forecasting in our society and, if so, where does it lie?

In the course of a recent study, I had a chance to ask people on various congressional staffs whether or not they believed there was a significant possibility that the world would face large-scale food shortages before 1985. Most agreed.

Then I asked why they thought the United States was not moving more forcefully in anticipation of this issue, to head it off, to reduce the impact of the crisis.

The answer inevitably was, "Our political system does not respond to the anticipation of a crisis, it responds only to the crisis itself."

This is the "white knight" syndrome: The dragon is in our own backyard breathing fire down our necks; the consequences are apparent to all. Who will save us? The white knight rides down from the hill and slays the dragon. Much cheering follows and the knight is not only revered but reelected.

Contrast that to the poor knight who can only say; I didn't slay a dragon, but my planning was effective enough to keep him away.

Where is the resistance to planning? To an important degree, it is in the reward structure of our political system.

Forecasting also meets resistance because it often brings only discouraging news. Several years ago, working under a grant from the National Science Foundation, our group was asked to project future crises which might be improved by the application of science and technology.

We reasoned through a set of future conditions, sorted and organized them, and, finally, presented a list of odious circumstances which seem plausible and relatively imminent.

One member of the audience at our final presentation said that we had indeed accomplished our mission, but he wondered where the comparable positive list was. We had presented a list of crises; where was the list of anticrises? As we thought about that problem, we

realized that the second list was much harder to prepare. In fact, there is not even a concise word in the language to convey the idea of "anticrisis" succinctly. At the top of that second list would be: Avoid all of the crises. What would the second entry be?

Some resistance to forecasting comes from a clash between academic disciplines. The sharpest division I know of is the split between conventional econometricians and system dynamicists. The former group models change by observing the statistical relationships among variables in the economy.

Input-output models of the sort produced at the Wharton School of the University of Pennsylvania and the University of Maryland are examples of this approach. System dynamics, on the other hand, focuses on casualty and produces systemic models which explain historical developments by defining the linkages among variables and rate-determining features of closed systems.

Subtle and powerfully descriptive simulations have been constructed using such techniques. The "limits to growth" model, constructed by Prof. Jay Forrester and Prof. Dennis Meadows, is an example of this approach.

The split between the econometricians and the system dynamicists is based on disagreement about the degree to which judgment, rather than observable historical relations, may be included in simulations.

Futures analysis and planning raise political issues of great significance. Who is to do the planning and who is to be planned for? Whose images of the future are likely to emerge from analyses of the future? What values and goals will predominate?

In short, futures analysis and planning raise concern about elitism—the vesting of new kinds of power in small groups—using approaches not open to public visibility. Because of this concern, the grassroots particularly futures activity is important and must, in my view, be preserved, developed, and incorporated into the national planning systems of the future.

In discussing the need for futures analysis in government, I have heard the argument that governmental planning equates to socialism. It is true, I suppose, that all socialistic governments plan, but it is not true that governments which plan must be socialistic.

The differences between planning in a socialistic setting and planning in a democratic setting are tremendously important. In both instances, planning involves establishing objectives and delineating priorities among these objectives.

In a socialistic setting, these objectives and priorities lead to enforceable rules; in a democratic setting, these objectives and priorities are cohesive guides to present action. In a socialistic setting, planning reflects the values and judgments of a small, centralized group. In a democratic setting, planning must involve participatory input.

Planning after all is a process of extracting from the future that which is best. Must we lose this opportunity because "planning" sounds like something the other guys do?

There is resistence to planning in government because it suggests increases in bureaucracy and there is disillusion about the effectiveness of government in any pursuit.

Finally, resistence to futures analysis comes as a result of the "muddling through" syndrome. The argument goes: Views of the

future are necessarily imperfect. Therefore, plans formed on the basis of these imperfect views must be imperfect themselves.

Therefore, we are likely to be misled by plans, taking wrong paths and missing opportunities which would be more apparent if only we had allowed randomness to stay in the system.

After all, it is argued, history has shown that our system is self-correcting and plans, even well intentioned plans, sometimes produce unanticipated consequences which are worse than the problems which the plans were designed to correct. We should, therefore, continue to "muddle through." The risks are fewer.

I agree with many points raised in this argument. Views of the future are imperfect and plans formed on the basis of these imperfect views will also be imperfect.

But having agreed that vision of the future is, at best, hazy, that plans will be incorrect, and that randomness is required, "muddling through" still seems to be the wrong answer. The problems we face now are not as simple as they were when "muddling through" worked. They are global. The time between their first manifestation and their effects on the lives of millions of people is very short. They may not yield to hasty, last-minute policies.

Question 4: How can long-range forecasting and planning assist us as a society in choosing our environment?

Planning at any level involves the following distinct but coupled activities:

MONITORING

This is the data-collecting phase. Within the Federal Government every agency does it now, but some more haphazardly than others.

FORECASTING

Based on the data about change-in-progress, this activity is designed to produce self-consistent images about future states.

GOAL SETTING

This is the normative function of asking what future states of affairs are desired?

ANALYSIS

This activity involves a comparison of the forecasted states with the desired states. It represents problem detection.

POLICY GENERATION AND TEST

When analysis shows a mismatch between desired and forecasted states, policies are nominated and tested to reduce the mismatch and to determine, to the extent possible, their side effects.

IMPLEMENTATION

Given a desirable policy, it should be implemented. The assumptions on which it is predicated should be stated and these assumptions, in addition to the outcome of the policy itself, should be specifically monitored.

Even if every agency in government worked this way, we certainly would not have a cohesive planning system for several reasons.

We have no mechanism for eliciting desirable future images from the public. Even if we did, it is likely that the agency plans would overlap, frustrate one another, and in some instances work to contrary objectives.

The recommended policies of each agency would have costs which, in the aggregate, might exceed available resources. Therefore, resource allocation tradeoffs would be necessary.

The view of how the agency plans linked to desirable national futures might be parochial and colored by agency biases not shared by the larger community.

Therefore, it is necessary to postulate a planning superstructure. There are many ways that this function could be accomplished, and I have outlined one in my written paper which involves viewing the Office of Management and Budget as the Office of Planning, supervised by a Presidential-congressional board with congressional checks and balances, but many alternatives might be imagined.

I tried to minimize the bureaucracy and promote flexibility.

I have postulated a system in which publicly generated images of desirable futures guide the Federal planning system. The Office of Planning, working with these images, issues guidelines to executive agencies which base their policies on these guidelines.

The agencies show in their budget requests how their intended activities correlate with and promote the desirable public images.

The Office of Planning resolves possible contradictions among agency plans. In addition, the Office of Planning links national plans into supranational issues.

In order to create a check and balance, the legislative sector of government has available to it data, analyses, and processing in the Library of Congress and the General Accounting Office, as well as through the presently developing congressional foresight function.

Furthermore, Congress, which must ultimately promulgate the new policies, performs analytic tests of these policies through the Office of Technology Assessment or through the General Accounting Office before they are implemented, to determine to the degree possible their consequences.

Having implemented policies, the monitoring system changes so that the consequences of the policies can be observed and, with this information, the success of the policies determined. Open publication of plans and data helps assure public scrutiny and creates the basis for new images in the next cycle.

There are many unanswered questions, for example, at present and in the system that I have outlined, budgeting provides the primary means of control, but what actions might be taken by organizations outside of the Federal budget process? How can contradictory images of desirable futures be accommodated? How can supranational planning links be established without unduly compromising national interests?

I believe we are at a point in our history when such questions can and must be faced and must be resolved.

I believe that it is only through the introduction of such a system that the Nation will be able to choose its environment effectively. Without such a system, the Nation will, at best, plan narrowly—suboptimizing to attack problems which have captured the immediate attention

of the public and the media. Suboptimization implies improving one situation at the expense of worsening others, and solving problems in the short term without adequate regard to long-run consequences.

Without futures research and planning, we delegate to chance, perhaps unkind chance, futures which we, all of us, might have helped design. We condemn ourselves to reaction, fighting crises never seen until too late to avoid. We leave to our children the legacy of unsolved, perhaps unsoluble, issues, some made worse by delay and failure to anticipate an act.

It is possible to do better than that; we owe it to ourselves and those who will follow us to try.

Senator CULVER. What do you do with those forecasts mentioned in your prepared statement? Do you computerize them or catalog them?

Mr. GORDON. We have found it too expensive to computerize them. But we have the forecasts in a manual base and we retrieve from that data base when we or some one else asks for a fast review of what's been forecasted previously on a given topic.

When we start a new study, this is often the first reference we make. The data base becomes a good anchor to the previous thinking. It is a history of forecasts. It will be interesting to go back to that file in 5 or 10 years and find out who was right and for what reasons.

Senator CULVER. Thank you very much, Mr. Gordon.

[Mr. Gordon's complete statement and responses to supplemental questions follow:]

THINKING ABOUT THE FUTURE AND THE ENVIRONMENT

Prepared for

Panel on Environmental Science and Technology
Senate Subcommittee on Environmental Pollution
Hearings on Future Analysis and the Environment
December 15, 1975

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INTRODUCTION

The Subcommittee has asked me to address four specific questions this morning and I am pleased to appear here to respond. The questions are:

- What institutions are available--within or outside of government--for futures analysis of the environment?
- How effective are the tools for futures analysis of the environment?
- Is there resistance to futures analysis and long-range forecasting in our society; if so, where does it lie?
- How can long-range forecasting and planning assist us as a society in choosing our environment?

These questions about futures analysis, planning, and the environment are particularly appropriate at this time. There is a growing appreciation that--with some important limitations--futures analysis is possible and necessary, and that planning at all levels is one of the most useful kinds of action now available to a society interested in protecting its future environment. Furthermore, the environment, particularly viewed on a global scale, is likely to be under unprecedented strains in the years to come. These strains result from a confluence of forces. Before addressing the four specific questions posed by the Subcommittee, I would like to discuss two extremely important environmental issues which will certainly have significance for the United States in the immediate future and which could be reduced in impact given forethought, planning, and courageous action. These issues are raw materials availability and world food supply.

primary environmental consequences, land use problems--particulary questions centering around the use of federal lands--would certainly arise; in addition, availability of water and disposal of solid wastes residuals of the mining process would be of great concern.

Futures analysis and planning provide a means for exploring the significance of these issues, their timing, and alternative approaches to their solution. Effective planning would include consideration of substitute materials, means for improving efficiency in the use of materials most likely to be in short supply in the future, use of by-product and waste material, improved mining processes, and various approaches to recycling. This list is certainly not complete, but it illustrates some areas in which cohesive planning and anticipatory action might make a difference. To wait and hope for large-scale value changes which would result in reduced economic growth and consumption is, in my view, unrealistic: the system inertia is too high; the lessons of the culture, too strong; the levels of expectation too high in the United States and elsewhere.

The National Commission on Materials Policy, the National Academy of Sciences, the National Science Foundation, the Environmental Protection Agency, the Department of the Interior, and more recently, the Office of Technology Assessment and the General Accounting Office have all undertaken studies and recommended programs in this area. Taken together, these studies find significant potential problems requiring foresight and planning. The National Commission on Supplies and Shortages is currently reviewing these issues; I would hope that its

recommendations reflect the global and systemic nature of the problem and the need for near-term action to avoid odious consequences in the long run.

A second example, one of perhaps even greater importance, which illustrates the need for futures analysis and planning in the environmental area, is the potential for world food shortages. That world population growth rate may exceed the rate of increase of agricultural production is well known. The trends which suggest that food will be in short supply include:

- Changes in agricultural trade have led to the U.S. and Canada supplying 85 percent of all exported grain. While this concentration may be economically advantageous, it means that any external event which could have the effect of diminishing grain exports from the United States and Canada could have immediate repercussions elsewhere. Among such events might be climatic disturbances, consumer demands for lower prices, crop diseases, etc. Nowhere in the world does there exist a world grain reserve which could "take up the slack" for more than a month or so in the event of disappointing harvests in North America.

- The increasing price of fuels has exacerbated the situation. Agriculture in most developed countries is energy intensive; energy supplies are used to run tractors, to dry grain, the produce fertilizer, and to power irrigation systems. The price of increasing the per acre productivity of grain has been increasing energy intensity. While the use of new hybrid grain varieties has increased productivity greatly, they have also increased the energy intensity of agriculture in the countries in which they are employed. It follows, therefore, that as energy shortages become more severe and the costs increase, the outcome of the "green revolution" becomes less certain.

- Agricultural output will have to grow at the same rate as world population--about 2.2 percent per year--simply to maintain the status quo. Whether or not developing countries--where population growth is concentrated--can continue to increase their production of food remains to be seen.

- New technology may not be able to help soon enough or to a great extent. To put it simply, many new and prospective agricultural technologies are expensive

and the countries that will need the food are poor. This effectively removes the economic incentive for developed countries to produce new foods and agricultural techniques.

- In many places agricultural expansion is plagued by problems associated with soil erosion, irrigation, and drainage. Fertilizers, insecticides, and pesticides, which are presently expensive and polluting, will be required to a greater extent as agriculture in these countries becomes more intensive.

- The agricultural infrastructure in many developing countries is inadequately developed. Distribution and preservation of food and inadequate market mechanisms are still important issues.

Agriculture is basically a polluting enterprise. As population levels increase, the amount of land under cultivation increases and the quality of agricultural land diminishes. Farmers plow valleys and then move to the hillsides, sometimes creating soil erosion problems, leading to floods and droughts. As the amount of land under cultivation increases, top soil is eroded, washed into the sea and lifted into the atmosphere. The increasing level of particulate matter in the atmosphere could affect the earth's climate through increasing albedo, the reflectivity of the atmosphere. The effect would be to lower the temperature of the earth. On the other hand, the increasing level of carbon dioxide in the atmosphere provides a greenhouse effect and tends to raise the temperature. Thus, these two forms of atmospheric pollution, each intensified by agriculture, are in delicate balance.

Irrigation throughout the world has contributed to food production by permitting cultivation of areas which normally would not be usable or only marginally productive. But along with its benefits, irrigation has some polluting side effects. These include raising of the water table by

the diversion of river water onto land, and increased salinity of the soil caused by the evaporation of the water.

Pesticides, insecticides, rodenticides, and fertilizers directly contribute not only to pollution, but also to increased agricultural productivity. The real confrontation between food and the environment is yet to come; when people are in dire need of food, preservation of the environment will certainly be of second priority.

Futures research, planning, and action in advance of the problem could help avert human suffering and environmental degradation which are almost sure to come. There is widespread awareness of the potential for future food shortages, yet we seem strangely impotent; the potential severity of the problem is not generally reflected in national policy or plans.

* * *

These two examples illustrate the intersection among futures analysis, planning, and the environment. While many other examples could be added to the list, I chose these global issues because of their overwhelming significance to our country. Both problems illustrate that "the environment," or indeed, almost any modern problem area, crosses disciplinary and geographical bounds, and involves systemic considerations of great complexity. Nevertheless, I believe that action based on planning is possible and necessary in addressing such problems to avoid future situations which are apt to be disastrous otherwise. I hold this belief despite the fact that futures analysis is an incomplete and imperfect guide to the future, and that planning carries with it the risks of error and elitism. Without futures analysis and planning, we delegate to chance--perhaps unkind chance--futures which we, all of us, might have helped design. We condemn ourselves

to reaction, fighting crises never seen until too late to avoid. We leave our children a legacy of unsolved, perhaps unsolvable, issues, some made worse by delay and failure to anticipate and act.

If the need for futures analysis and planning is clear, then it is quite appropriate to review where the field stands.

WHAT INSTITUTIONS ARE AVAILABLE--WITHIN OR OUTSIDE OF GOVERNMENT--FOR FUTURES ANALYSIS OF THE ENVIRONMENT?

The number of organizations which contribute to or perform future analysis of some sort is very large. There is, of course, no accurate census, but using several published directories and sampling the opinion of several of my colleagues, I am led to think that currently in the United States there are about:

- 10 or 15 journals and newsletters which deal regularly with "futures" topics and perhaps another 100 or so that have periodic or occasional articles about the field.
- 30-50 active public participatory organizations known as "Year 2000" groups concerned with future issues and opportunities in regions, states, and cities.
- 100 independent organizations--either profit or non-profit--which perform futures analyses of some aspect of the environment, either full time or part time.
- 150 groups which are part of larger organizations (e.g., long-range planning departments of corporations) which engage in this activity.
- 300-400 university courses dealing with "futures" from either a substantive or methodological viewpoint, and uncountable high school courses.

To give another perspective to the size of the field, at The Futures Group we have been systematically scanning publications over the past four and a half years to establish a file of published forecasts of future events. Over this period an average of two readers have been assigned almost continually. They review professional journals, trade publications, the popular press, and other sources. So far, this scanning has produced

approximately 50,000 entries derived from over 5000 sources and we are adding forecasts at the rate of about 200 per week.

Organizations performing futures analyses may be classed by organizational form:

- Profit or non-profit
- Public or private
- Independent or affiliated
- Full time or part time

or by the type of work primarily performed:

- Substantive research, including policy analysis, forecasting, and technology assessment
- Publishing of futures-related information
- Education in the futures field
- Management consulting in planning and futures research

Some of the organizations engaged in policy analysis, futures research, technology assessment and other allied activities are listed below:

- Several private firms perform futures research studies as their primary service. The Futures Group and Forecasting International, Ltd., for example, are full time, independent, private and profit making; each performs contract studies for both government and private clients, including technology assessments conducted under contract to the National Science Foundation, and others. The Futures Group now has 44 staff members and has, over the past four and a half years, worked for more than 250 clients.

- The Institute for the Future of Menlo Park, California and The Center for Futures Research at the University of Southern California also perform futures oriented studies for private and government clients. However, both are non-profit. While the Institute for the Future is an independent organization, The Center for Futures Research is affiliated with the University of Southern California.

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- Well known research organizations, such as Arthur D. Little, Battelle Memorial Institute, and Stanford Research Institute, also perform contract futures-oriented studies for government and private clients, in addition to their other work.

- Chase Econometric Associates and Data Resources Incorporated are examples of corporations which publish information about the future. In this instance each has developed an extensive macroeconomic computer model and, based on this model, publish economic forecasts for the United States as a whole and for selected industries. Incidentally, both firms provide on-line services which permit clients to ask "what if" questions through the use of macroeconomic models.

- Architectural and engineering firms, working for private and government clients, prepare environmental impact statements, perform technology assessments, and produce data to enhance current decisionmaking.

- Within many large corporations, planning groups, market research organizations, and research and development departments perform futures analyses of various sorts, ranging from studies of prospective ventures to identification and revision of corporate strategy.

- In government, there are many organizations which utilize forecasting and systematic policy analysis in accomplishing their missions, including (to name only a few) the Federal Aviation Administration, the National Aeronautics and Space Administration, the Environmental Protection Agency, the Department of Defense, the Central Intelligence Agency, the Congressional Budget Office, the Office of Technology Assessment, the Department of Agriculture, the Federal Judicial Center, and the General Accounting Office.

HOW EFFECTIVE ARE THE TOOLS FOR FUTURES ANALYSIS OF THE ENVIRONMENT?

The methods of futures analysis--and there are many--are both qualitative and quantitative. Most of these methods were derived from operations research, systems analysis, or other well-established disciplines. Among the qualitative approaches are techniques for collecting and refining expert judgment about future developments through questionnaires, interviews, and interactive computer conferencing. These qualitative approaches also include simulation gaming, in which participants role play and attempt to anticipate reactions of groups in novel situations, and participatory approaches involving public debates about desirable future states of affairs and future threats through standard polling, "town meetings," and interaction through TV, radio, and newspaper media.

Among the quantitative approaches are a variety of mathematical techniques for extrapolating historical data and model building; these can be used to form scenarios and probabilistic descriptions of future conditions.

No matter what methods are used in forecasting, there are some important limitations which must be recognized.

- Forecasting can be only partially accurate. In forecasting future technological events, a batting average of two-thirds correct over a period of ten years or so is to be expected; social and value forecasts are probably less accurate.

- Forecasts of environmental change will omit developments which, in retrospect, will seem important. Some of these omissions are inevitable since a component of the future is essentially unknowable--not just unknown, but intrinsically hidden from discovery. Such developments are discontinuities of thought, mutations. Presidential assassinations, basically new scientific phenomena, and the emergence of charismatic leaders, all these might be anticipated in concept, but their precise nature remains hidden to the forecaster.

- Value issues are of great significance, but difficult to resolve. A distinction should be made, for example, between a desirable future and a likely future. Too often, during forecasting, one is tempted to believe that a desirable situation is more probable, and a situation which appears distasteful, less probable.

- Values change with time. Some circumstances which seem disasterous to us might be useful, natural, and beautiful to some future society. When values change, and they must, how can planners judge what will be desired? Plans are often based on current values and yet judgments about their success or failure will certainly be based on future values.

Almost all of the methods of futures analysis involve extrapolation of historical data. Even complex models assume that the structure of the system which they simulate--as determined by historical data--will continue to exist in the future. Inevitably, the assumption that the future will look like the past will be incorrect. Forces in the future will be different than in the past and these forces will change trends, variances, correlations, and the higher frequency components involved in extrapolations. Some systems can change more rapidly than others; in this respect, some systems may be thought of as having high or low inertia; nevertheless, all systems can change as a result of unprecedented forces.

The essence of futures research is the identification and analysis of such unprecedented developments. At The Futures Group we have begun to develop techniques for explicitly incorporating data and perceptions

about unprecedented forces and events in otherwise extrapolative methods. This is an important frontier of research on methodology which will not only improve forecasting accuracy and the understanding of uncertainty in forecasts, but will also help establish the sensitivity of future conditions to an array of forces for change and thus will contribute to the analysis of policy. By and large, these new techniques require:

- Establishing the historical base which describes the system under consideration.
- Extrapolating these data to form an idea of where change-in-progress would carry the system, all other things being equal.
- Identifying those forces for change--those unprecedented events--that will make the future different than the present and past.
- Judging the probability and impact of these events singly and in combination.
- Statistically combining these judgments with the extrapolation in order to form a forecast which recognizes the momentum of the system, as determined by its past development, as well as the set of unprecedented developments.

There are many instances in which futures analysis has been important in environmental planning. I have listed a few below as examples.

- Despite the controversy surrounding the usefulness and necessity for environmental impact statements, as a set they constitute an effort to think through the consequences of certain activities on the future environment.
- The Monsanto Corporation, in attempting to reach a decision about introducing a newly developed plastic for soft drink containers, employed many futures analysis techniques in an attempt to anticipate the consequences on society and the environment of developing the plastic. These analyses played an important role in their final decision.
- In a recent study performed under contract for the National Science Foundation, The Futures Group studied impediments to the development of geothermal energy in the United States,

the means for stimulating the growth of this energy resource, and the consequences--social, political, environmental, economic--of the various policies recommended.

- The Environmental Protection Agency has developed a sophisticated simulation model, Strategic Environmental Assessment System (SEAS), to project the consequences of changes in economic and industrial activity on precisely defined measures of the environment. One specific application of SEAS has been to assess the environmental consequences of onshore activity in four New Jersey coastal counties resulting from offshore oil development for the Bureau of Land Management. Another application was to assess the impact of motival substitution in auto manufacturing on resource recovery.

- The Stanford Research Institute recently held a symposium for the Environmental Protection Agency; experts who attended were asked to provide their judgments about important research directions for the agency in view of potential future problems which they perceived.

- The Office of Technology Assessment has contracted for a number of futures-oriented studies including analysis of stockpiling policy; information requirements in agriculture; access to Federal lands; potential offshore and coastal zone impacts of deepwater ports, floating nuclear power plants, and oil exploration and production; present and future impacts of technology on the U.S. fishing industry; alternative institutional structures for a national materials information system; and agricultural waste conversion.

This list is very incomplete, but it serves to indicate that futures analysis is being used in the identification and evaluation of the environmental options. How effective are these techniques? At the very least, they broaden the perspective of policy analysis by providing a means of inquiring about:

- Secondary and tertiary consequences of contemplated actions.

- Non-economic costs and benefits of policies.

- Effects of actions on various interest groups.

- Sensitivity of the outcome of proposed policies to various external developments.

These seem modest enough objectives, but to attain them with any sense of complete objectivity is difficult yet necessary to effective planning.

IS THERE RESISTANCE TO FUTURES ANALYSIS AND LONG-RANGE FORECASTING IN OUR SOCIETY: AND IF SO, WHERE DOES IT LIE?

In the course of a recent study, I had a chance to ask people on various Congressional staffs whether or not they believed there was a significant possibility that the world would face large-scale food shortages before 1985. Most agreed. Then I asked why they thought the United States was not moving more forcefully in anticipation of this issue, to head it off, to reduce the impact of the crisis. Certainly there are many activities which we and other developed nations might pursue in order to help avert future starvation; for example, placing more emphasis on the development of labor-intensive technology which would be well suited to the agricultural systems of developing nations; more vigorous funding of research and development programs related to increasing agricultural productivity; studying how best to arrange our agricultural economic system to encourage exports without unduly impinging on domestic food prices; and reaching a new understanding of how to bring marginal lands into more productive use, both in the United States and abroad. The answer inevitably was: "Our political system does not respond to the anticipation of a crisis--it responds only to the crisis itself."

This is the "white knight" syndrome: the dragon is in our own backyard breathing fire down our necks; the consequences are apparent to all. Who will save us? The white knight rides down from the hill and slays the dragon. Much cheering follows and the knight is not only revered but reelected. Contrast that to the poor knight who can only say: I didn't

slay a dragon, but my planning was effective enough to keep him away. Big deal!

Where is the resistance to planning? To an important degree, it is in the reward structure of our political system.

Forecasting also meets resistance because it often brings only discouraging news. Several years ago, working under a grant from the National Science Foundation, our Group was asked to project future crises which might be improved by the application of science and technology. We reasoned through a set of future conditions, sorted and organized them, and, finally, presented a list of odious circumstances which seem plausible and relatively imminent. One member of the audience at our final presentation said that we had indeed accomplished our mission, but he wondered where the comparable positive list was. We had presented a list of crises; where was the list of anti-crises? As we thought about that problem, we realized that the second list was much harder to prepare. In fact, there is not even a concise word in the language to convey the idea of "anti-crisis" succinctly. At the top of that second list would be: avoid all of the crises. What would the second entry be?

Some resistance to forecasting comes from a clash between academic disciplines. The sharpest division I know of is the split between conventional econometricians and system dynamicists. The former group models change by observing the statistical relationships among variables in the economy. Input-output models and macroeconomic models of the sort produced at the Wharton School of the University of Pennsylvania and the University of Maryland are examples of this approach. System dynamics, on the other hand, focuses on causality and produces systemic models which

"explain" historical developments by defining the linkages among variables and rate-determining features of closed systems. Subtle and powerfully descriptive simulations have been constructed using such techniques. The "limits to growth model," constructed by Professor Jay Forrester and Professor Dennis Meadows, is an example of this approach.

The split between the econometricians and the system dynamicists is based on disagreement about the degree to which judgment, rather than observable historical relations, may be included in the simulation. With system dynamics, many relationships are based on judgment not determined by historical data. The modeler can, therefore, include in the model some of his perceptions about relationships which determine how the system functions. For the econometrician, this is a dubious process. The system dynamicists, for their part, have argued that the models constructed by econometricians are artifacts of past data and cannot be responsive to changes in the environment which cause major shifts in the system being modeled.

The same kind of conflict exists, at least to some degree, between well established disciplines, and the protodiscipline of futures research. While futures research has "borrowed" many of its methods from other fields--statistics, psychology, systems analysis, and the social sciences--the field is generally outside of the bounds of the other disciplines. Its practitioners have widely varying backgrounds and, to be frank, the work has been of widely varying quality. The field is not yet a discipline; it lacks the precision of a science; its methods are not yet well organized and codified; accepted standards of professionalism are yet to be made explicit and shared widely.

Futures analysis and planning raise political issues of great significance. Who is to do the planning and who is to be planned for? Whose images of the future are likely to emerge from analyses of the future? What values and goals will predominate? In short, futures analysis and planning raise concern about elitism--the vesting of new kinds of power in small groups--using approaches not open to public visibility. Because of this concern, the grass roots participatory futures activity is important and must, in my view, be preserved, developed, and incorporated into national planning systems of the future.

In discussing the need for futures analysis in government, I have heard the argument that governmental planning equates to socialism. It is true, I suppose, that all socialistic governments plan--but it is not true that governments which plan must be socialistic. The differences between planning in a socialistic setting and planning in a democratic setting are tremendously important. In both instances planning involves establishing objectives and delineating priorities among these objectives. In a socialistic setting, these objectives and priorities lead to enforceable rules; in a democratic setting, these objectives and priorities are cohesive guides to present action. In a socialistic setting, planning reflects the values and judgments of a small, centralized group; in a democratic setting, planning must involve participatory input. Planning after all is a process of extracting from the future that which is best. Must we lose this opportunity because "planning" sounds like something the other guys do?

Finally, resistance to futures analysis comes as a result of the "muddling through" syndrome. The argument goes: views of the future are

necessarily imperfect. Therefore, plans formed on the basis of these imperfect views must be imperfect themselves. Since the chances for error in planning are likely to be great, we are likely to be misled by plans, taking wrong paths and missing opportunities which would be more apparent if only we had allowed randomness to stay in the system. After all, it is argued, history has shown that our system is self-correcting and plans, even well intentioned plans, sometimes produce unanticipated consequences which are worse than the problems which the plans were designed to correct. We should, therefore, continue to "muddle through"--the risks are fewer.

I agree with many points raised in this argument. Views of the future are imperfect and plans formed on the basis of these imperfect views will also be imperfect. Randomness is important. Take, for example, the need for unplanned scientific research. In many instances the products of research are so obscure at the time research is performed that the planning cannot be effective. Using Kistiakowsky's example: "who could have foreseen, at the time of their research, that the Curies would make a major contribution to the cure of cancer? Similarly, no man today is wise enough to know from what field will come a critical discovery that will directly or indirectly solve the problem of the control of insects." Sometimes the research which seems to be the least promising proves to be the most fecund.

But having agreed that vision of the future is, at best, hazy, that plans will be incorrect, and that randomness is required, "muddling through" still seems to be the wrong answer. The problems we face now are not as simple as they were when "muddling through" worked. They are global. The time between their first manifestation and their effects on

the lives of millions of people is very short. They may not yield to hasty, last-minute policies.

Where then does that leave us? It leaves us with the recognition that flexibility in planning is required, that plans must be changeable as new information is obtained, that planning is indeed a continuing process rather than a single event, that the search for information is an important aspect of this process, that planning must be designed to promote rather than stifle innovation, that the process should lead to cohesive guidelines, and that the principles of democracy must shape the planning process.

HOW CAN LONG-RANGE FORECASTING AND PLANNING ASSIST US AS A SOCIETY IN CHOOSING OUR ENVIRONMENT?

Planning at any level involves the following distinct but coupled activities:

- Monitoring. This is the data collecting phase. Within the Federal government every agency does it now, but some more haphazardly than others.

- Forecasting. Based on the data about change-in-progress, this activity is designed to produce self-consistent images about future states.

- Goal setting. This is the normative function of asking what future states of affairs are desired?

- Analysis. This activity involves a comparison of the forecasted states with the desired states. It represents problem detection.

- Policy generation and test. When analysis shows a mismatch between desired and forecasted states, policies are nominated and tested to reduce the mismatch, and to determine, to the extent possible, their side effects.

- Implementation. Given a desirable policy, it should be implemented. The assumptions on which it is predicated should be stated and these assumptions, in addition to the outcome of the policy itself, should be specifically monitored.

It seems to me that in a democracy, the goal-setting portion of the planning process should be a citizen responsibility. Suppose for a moment (I'll return to this point later) that through some participatory process, desirable images of the future were in hand and well defined. These could serve as the basis for national planning. Each executive agency and department requesting funds for activities which could have a substantial impact on the environment might be required to:

1. Produce forecasts showing expected changes within the agency's domain of interest (forecasting).

2. Show where mismatches exist between the forecasted states and the desired states (analysis).

3. Lay out potential policy actions to avoid or mitigate these mismatches, indicating who has the ball, what the actions would cost, and their expected primary and secondary consequences (policy generation and test).

4. Rationalize the data collection and dissemination procedures to make them relevant to the agency's forecasting, operations, and policies (monitoring).

Each year the previous year's plan would be reviewed by the agency, the actual outcome of past activities compared with the intended outcome, reasons for discrepancies articulated, and corrective measures instituted.

If this were all that were done, the nation certainly would not have a cohesive planning system for several reasons:

- The agencies, working within their domain of interest, would produce plans linked to national futures seen as desirable by people in society; it is likely, however, that these plans would overlap, frustrate one another, and, in some instances, work to contrary objectives.

- The recommended policies of each agency would have costs which, in the aggregate, might exceed available resources; therefore, resource allocation tradeoffs might be necessary.

- The view of how the agency plans linked to desirable national futures might be parochial and colored by agency biases not shared by the larger community.

Therefore, it is necessary to postulate a planning superstructure which would have the following functions:

1. Providing data to the public participatory process about existing and potential national and international issues and opportunities.

2. Working with the participatory apparatus to arrive at a clear statement of desirable futures.

3. Devising a priority structure for forecasted issues.

4. Setting forth assumptions and guidelines for all agencies in clearly stated operational terms.

5. Reviewing agency plans to help assure that the operations of the various agencies are complementary.

6. Recommending resource allocations, if necessary.

7. Coordinating with international agencies involved in global problem detection and correction.

8. Coordinating and periodically publishing information about the status of the nation's planning activity.

There are many ways these functions could be accomplished. Imagine:

- An Office of Planning could be created within the Executive Department. This Office might assume the responsibilities of the current Office of Management and Budget, but, in addition, take on new planning responsibilities.

- A supervisory board could be created for the new Office of Planning. This board could have three types of members: those designated by the President, those designated by Congress, and publicly elected directors.

- The Congressional Research Service of the Library of Congress, the General Accounting Office, and the Office of Technology Assessment could have new planning support activities. For example:

  °The Congressional Research Service could collect and review for Congress the data used by the executive agencies in the pursuit of their monitoring tasks.

  °The General Accounting Office could be charged with establishing an independent systems analytic capability with which problem forecasts and policy analyses could be carried out independently by Congress.

  °The Office of Technology Assessment or the Congressional Research Service could have the responsibility of publishing an inventory of, and tracking, world issues which might affect the American environment, together with assessments of their likely severity.

- The Office of Technology Assessment or the General Accounting Office might be asked to use their skills to perform "legislative assessments," analyzing high order impacts of important proposed legislation designated by Congress to bring to public discussion possible side effects of contemplated legislative policies. This would be akin to applying the provisions of the National Environmental Policy Act to the actions of Congress as well as the bureaus and agencies of the Executive.

Which now brings us to the most difficult aspect of the matter: eliciting and including public input into this process. I believe any planning system which leans heavily on public input--which is necessary--should include safeguards for minority positions and interests which could be submerged by "median" opinions. More specifically, public input into the planning process might be obtained in the following ways:

- The Congressional oversight function of the Office of Planning would certainly include approval of plans, and this approval process would include public hearings.

- A "citizens' assembly" might be convened; this meeting would involve representatives from various groups in society who would discuss alternative futures and national options and would recommend what they considered to be desirable futures to the public at large.

- "Alternative futures" might be introduced into national and local elections, with candidates postulating their own normative views of the future.

- The "Year 2000" groups which have formed in many states in response to state or private initiatives, might be called on to recommend alternative futures to the planning system.

The system which is implemented to collect public sentiment about desirable futures must be dynamic. The images of the future pursued by the planning system must be seen as images-in-transit, changing as old goals are achieved, and as new expectations are generated. The system must guard minority positions and preserve a plurality of values.

In summary, I have postulated a system in which publicly generated images of desirable futures guide the federal planning system. An Office of Planning, working with these images, issues guidelines to executive agencies which base their policies on these guidelines. The agencies show in their budget requests how their intended activities correlate with and promote desirable public images. The Office of Planning resolves possible contradictions among agency plans. In addition, the Office of Planning links national plans into supranational issues. In order to create a check and balance, the legislative sector of government has available to it data, analyses, and processing in the Library of Congress and the General Accounting Office, as well as through the presently developing "foresight function" in the Committees and in the Congressional Budget Office. Furthermore, Congress, which must ultimately promulgate the new policies, performs analytic tests of these policies through the Office of Technology Assessment or through the General Accounting Office before they are implemented, to determine, to the degree possible, their consequences. Having implemented policies, the monitoring system changes so that the consequences of the policies can be observed and, with this information, the success of the policies determined. Open publication of plans and data helps assure public scrutiny and creates the basis for new images in the next cycle.

There are many unanswered questions in this system. For example, in the system that I have outlined, budgeting provides the means of control--but what actions might be taken by organizations outside of the federal budget process? How can contradictory images of desirable futures be accommodated? How can supranational planning links be established without

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unduly compromising national interests? I believe we are at a point in our history when such questions can and must be faced and must be resolved.

I believe that it is only through the introduction of such a system that the nation will be able to choose its environment effectively. Without such a system, the nation will, at best, plan narrowly--suboptimizing to attack problems which have captured the immediate attention of the public and the media. Suboptimization implies improving one situation at the expense of worsening others, and solving problems in the short term without adequate regard to long-run consequences.

It is possible to do better than that; we owe it to ourselves and those who will follow us to try.

RESPONSES FROM THEODORE GORDON TO SUPPLEMENTAL QUESTIONS FROM SENATOR CULVER

Q. Can you tell us specifically how you conducted the environmental study on geothermal energy and what implications it might have for this Panel's hearings on futures analysis?

A. The study to which you refer was performed by The Futures Group under contract to the National Science Foundation and was completed in early 1975. Bechtel Corporation was a subcontractor to The Futures Group in this work. The study began with interviews of technologists and geologists; these interviews were designed to ascertain the range of opinions about the state-of-the-art of the technology and the extent of the resource. The geothermal resource includes steam, hot water, geopressured deposits, hot dry rock, and magma. Technology is available for steam. The hot water resource necessitates the development of technologies which can cope with mineral deposits and scaling; in addition, more efficient heat-exchangers may be useful. The development of the geopressured resource requires new types of energy conversion devices (pelton wheels, for example). The use of hot dry rock depends on the rate of heat flow into the rock and the balance between this flow and the rate of heat extraction. The magma resource was deemed to be beyond the scope of the study. In summary, the first phase of the study indicated that while some technological developments were required, most of the technology was nearly at hand. However, the extent of the resource is still quite uncertain.

The second part of the study dealt with forecasting the rate of acceptance of this new energy source by utility companies. A small computer model was built which simulated the utility executives' decision process in selecting from alternative primary energy sources: coal, natural gas, fuel oil, solar, and geothermal. This model permitted us to project the rate of growth of the use of this resource in view of the way it seemed likely to satisfy utility decision criteria. These criteria included: capital investment, operating costs, perceived longevity of supply, environmental factors, cost of electricity, and time between decision and operation. The model showed that under a reasonable set of assumed conditions, it would be plausible to expect that geothermal sources could produce 10 percent of the nation's electricity by the year 2000.

The third part of the study was devoted to the analysis of impacts of the evolution of geothermal energy. Once again, interviews provided a primary source of information. Information derived from the interviews was expanded and grouped into a number of problems for detailed study. We found that the presence of geothermal in the energy mix would result in a decrease in the number of nuclear plants required, a decrease in the number of coal-fired plants required, a decrease in the amount of oil imported, an increase in the amount of coal available for export, and stimulation of a number of new industries designed to support the geothermal industry. Socioeconomic and environmental impacts were felt primarily in the west because geothermal resources are concentrated there. We found that a number of countries other than our own were likely to develop their geothermal resources; hence, this technology provided a new opportunity for the United States to develop exports of commercial importance. In addition, the development of geothermal energy in the western United States would become, we felt, a factor in the argument for developing a transcontinental electrical grid.

As for environmental impacts, we found we could classify them as either innocuous or potentially dangerous. Certainly, there are local impacts associated with the use of geothermal resources, including: odor, noise, and run-off. Among the potentially more serious environmental impacts are: contamination of surface water supplies, seismicity, and subsidence. We formed the opinion that these dangers were not so great that geothermal development should be diverted; rather, they are matters which deserve close scrutiny but probably can be avoided in most instances.

You asked what implications this study might have for the panel hearings on futures analysis. I believe that it might make a good case study which demonstrates how futures research and technology assessment can be useful in the policy analysis process. I've enclosed a copy of the report with this letter should you wish to review it in more detail.

Q. In the short term, how can a public official ever see the advantage of long-range forecasting?

A. This is a most difficult area. The political system seems to reward officials who can take actions which minimize the consequences of a crisis after the crisis

has come to public attention. However, officials who move in advance of a crisis and thus diminish or avoid the crisis entirely, seldom can gain much public attention for their work. In addition, long-range planning often involves forecasting into a time period which is beyond the tenure of the office of the official. Thus, the incentives for thinking far ahead have not been strong. How then do the advantages of long-range forecasting become apparent to public officials? In my view, through changing public awareness of the importance of planning. When any issue reaches a relatively high level of public attention, it automatically becomes a matter of concern for public officials. I believe that the future is no longer being taken for granted by the public. They are, more than ever, looking to their elected representatives to help them bring about a more desirable state of affairs, to be concerned about the implications of change, and to work to avoid crises. There was a time when almost every crisis was a surprise; that is no longer the case, since futures research permits us to measure the size and timing of some perspective issues before they inundate us. These issues are beginning to take hold in public awareness and as a result the public will expect their representatives on all levels to be equally aware of coming issues and to act to avoid them.

Q. You have spoken of the need for decentralized citizen participation in the planning process. How should such participation be structured? How could the Congress facilitate such participation?

A. As I mentioned during the hearings, I believe there are many problems which require careful and meticulous analysis. This kind of analysis cannot be the subject of a vote; it rests on facts and statistical inference. It would be wrong to structure citizens participation to contribute such matters. For example, the question of whether or not freon will interfere with the ozone layer is a matter best probed by a few specialists using carefully chosen laboratory and mathematical tools.

The role for citizen participation is, I believe, in goal setting and in the resolution of trade-offs.

The state "2000 group" activities provide an example of the former activity. When The Future Group worked with the State of Maine, citizens were presented a number of potential problems which we and state planners felt the State might face between the present and the year 2000. Participants at the meetings were asked to add to the list and to provide their judgments about the probabilities of these problems and their potential severity. By this means, the participants were able to rank order potential problems deserving the attention of state planners, and thus a set of priorities was produced. These were specific targets for planning, not general, motherhood goals. Once these issues had been articulated, they could, of course, be held up for wider public scrutiny and more detailed review.

As for the trade-off function of public participation, I mean collecting judgments about whether certain expected public benefits are worth the public costs which will be required to achieve them. For example, when environmental regulations are established which require the burning of low sulfur coal or fuel oil, I believe it would be desirable to state the expected economic costs as well as the expected environmental payoff. Then public participation at regulatory hearings, for example, would be useful in helping to determine whether or not the action under study was warranted.

In the next few sentences, I have listed my thoughts about how citizen participation might be structured and how Congress might facilitate this participation:

—The Congress might encourage formation of citizen groups which provide advice and judgment to state planning agencies. This would be official sanction for the "Year 2000 groups." Congress might provide some grant funding or incentives for encouragement of such participation planning

—An agency of the Federal Government, perhaps the Library of Congress or the Office of Management and Budget, might be directed to provide analytic assistance to these groups. In addition, national scenarios which depict potential future situations for the United States might be furnished to these groups for their review, critique, and use in their own activities.

—Should a planning function be established in the Federal Government, public input on priorities will be essential. These inputs might come from the "Year 2000 groups," state planning agencies, public hearings held by Congress, referenda on key issues, federally sponsored opinion polls, etc.

—Proposed legislation and regulation should be the subject of assessment, much as technology assessments are currently performed. It is important to think through the costs and benefits of proposed actions so that, to the degree possible, higher order consequences can be taken into account from the outset. Such studies would be useful in providing information to the public about costs and benefits of proposed actions. The results of legislative and regulatory assessments could provide the framework for public hearings.

—Congress might cause to be published reports on the future of the United States which would be designed specifically to show alternative paths open to the country and issues likely to be faced. These reports could be the basis for public debate and discussion about the appropriate role for our country.

Q. What should be done to change the rewards structure of the political process to remove resistance to futures analysis in public policy analysis?

A. As I mentioned earlier, I believe that increasing public awareness about potential future problems and increasing public sensitivity to long-range issues will inevitably lead public officials to include long-term considerations in their thinking. Of course, short-term issues will always be present, but public concern about the future will tend to shift the balance. In addition, the reward structure would also be shifted by:

—The introduction of national planning activities.

—Publication of a list of national issues likely to be faced by the Congress.

—Establishment of an analytic arm in Congress which could conduct early warning reviews and legislative assessments of the sort mentioned earlier.

—Introduction of a "foresight" provision in the Senate.

—Instructing the CBO to include social, demographic, technological, and international forecasts with their economic projections.

Q. In your opinion, what particular kinds of models and forecasting techniques have proven to be reliable?

A. Generally, large-scale simulation models can be divided into two major classes: econometric models and systems models. Econometric models are generally based on statistical relationships among the dependent variable and a set of independent variables. Systems models are simulations which attempt to reconstruct the actual functioning of the system under study. For example, an econometric type model designed to project fuel usage might be based on equations which relate fuel usage to size of the population, average driving speeds, price of gasoline, and other factors. The equation would be constructed by observing the statistical relationships between such parameters over the past decade or so. A systems model designed to project fuel usage would attempt to derive the number of automobiles likely to be on the road and the distance these automobiles would be driven; both of these functions flowing in turn from demographic and economic internal loops. The first type of model is statistical and the second, structural. Generally, econometric type models are used for short-term projections where accuracy is needed. Systems-type models are used for longer term projections.

Both types of models assume that historical relationships will extend into the future. In the long term, this assumption is incorrect. Therefore, we believe that it is important to find ways to introduce perceptions about unprecedented events into large-scale simulation models. These events might, for example, change system structure if they occurred, or they might amend the way that independent variables correlate with one another. When unprecedented future events are included in such models, they become non-deterministic and forecasts are produced which indicate a range of plausible outcomes. Such models have the advantage of demonstrating the uncertainty implicit in particular situations. Furthermore, this approach is useful in illustrating the sensitivity of outcomes to changes in probability of key future events.

While simulation modeling of the sort described above is exceedingly important in futures research, it is by no means the only technique in use. It is often necessary to collect expert opinion about future developments. We have been disappointed in the use of questionnaires for such work, and have instead developed a technique for interviewing experts which we have found produced very rich information. Experts are anonymous to one another and interact with professional interviewers in a carefully planned interview structure. The information derived from the group as a whole is collated and fed back to individuals of the group in a second

interview. As in previous judgmental techniques, this feedback process tends to produce convergence of opinions, or at least identifies reasons for significant disagreements.

Finally, most of the work of The Futures Group invovles policy analysis rather than forecasting per se. The distinction is important: forecasting produces lists of what might be. In policy analysis, forecasts become a setting for the analysis of the outcome of potential decisions. In the former case, futures research work can be interesting and stimulating; in the latter, the work can provide information on which action decisions can be justified.

As for reliability, enough time has passed now to evaluate the accuracy of forecasts made more than a decade ago. For technological forecasts, the batting average seems to be about 66 percent; in other words, about two-thirds of expected developments occurred about when they were expected. Although detailed studies have not been performed in the economic, social, and political areas, the general feeling is that the success rate in these domains is lower. In addition, many events have occurred which were not forecasted; we believe strongly that a component of the future is unknowable—not just unknown—and cannot be discovered by any systematic forecasting process. As I mentioned earlier, we are now moving toward the quantification of uncertainty where possible and we are experimenting with planning techniques which take explicit account of uncertainty in determining the potential pay-off and risks of contemplated actions.

Let me point out that the notion of reliability is somewhat paradoxical. Forecasts are made in order to provide a backdrop for planning. If the work of the forecaster is successful, then action will be taken to avoid odious developments and achieve desirable developments. Thus, the mark of the usefulness of forecasting is the degree to which it rationalizes the planning process. In this regard, most of us in the field believe futures research has made a contribution.

Senator CULVER. Next we have Dr. Carl Madden, chief economist of the U.S. Chamber of Commerce in Washington, D.C., and a member of the board of directors of the World Futures Society. He is the author of numerous articles on growth and change and the book *Clash of Culture*.

I welcome you here, Mr. Madden. You may proceed.

STATEMENT OF DR. CARL H. MADDEN, CHIEF ECONOMIST, U.S. CHAMBER OF COMMERCE, AND A MEMBER OF THE BOARD OF DIRECTORS OF THE WORLD FUTURES SOCIETY

Dr. MADDEN. Thank you very much, Mr. Chairman.

I will submit my statement for the record and try to summarize it not by reading from it but by paraphrasing it.

[The statement appears at p. 56.]

It is a pleasure for me to be here. I consider these hearings to be extremely important, as others who have testified here.

In general, I was asked to answer three questions: (1) What does the experience of the private sector confirm about the need for long-range forecasting in our society; (2) what can business experience teach us about forecasting; and (3) can futures analysis help us choose our environment? If so, how?

U.S. business has had, by one reckoning, about 50 years of experience in economic forecasting if one dates this forecasting from the work of Clarence Ayres of the Cleveland Trust Co. in the 1920's.

Another indication would suggest about 30 years of experience on any significant scale for large corporations. This experience derived itself from the stimulus to the subject of economics given by the debate over the Employment Act of 1946 and from the growing recognition by large corporations after World War II that economists and economic forecasting had something useful to offer to the business executive.

The debate over the Employment Act of 1946 gave rise to the academic opinion that was characteristic of the neo-Keynesians. Their pessimistic view was that the American economy was due for stagnation, the private economy that is, because they thought they foresaw that inventions would be labor saving rather than industry creating, that the geographic frontier's disappearance would limit geographic expansion, and that a population become stable would limit demand.

Business and its economists attacked such ideas, what George Terborgh, of the Machinery and Allied Products Institute called The Bogey of Economic Maturity, in a book that was given almost no attention among academic economists but, nevertheless, proved to be more accurate than the forecasts of the stagnationists.

Business economists numbered eight in U.S. corporations in 1944. By now, there are approximately 3,500 to 4,000 economists employed by U.S. business firms and about 2,100 members of the National Association of Business Economists.

Because the Employment Act of 1946 was changed in the debate from a Full Employment Act that would have authorized central economic planning—the view of Senator Murray of Idaho, its author, and of his allies among labor groups and political groups designated as liberal—to an act which was moderate in its impact but did pledge all the "plans, functions and resources" of the Federal Government to fulfill the responsibility of maintaining high employment, we have relied upon the market economy primarily in the post-World War II period for allocating resources.

The predominance of the market economy has made economic forecasting in U.S. business more reliable than it might otherwise have been if the original Full Employment Act had been passed, because the calculus of market behavior has underlying patterns of stability based on well-studied logic, whereas political developments are much more difficult to forecast.

Business has learned some lessons from business forecasting. I would like to mention them and comment on them.

The first and perhaps the most crucial lesson is that the art of forecasting will probably forever remain imperfect and that those who demand or expect that forecasting will be indeed quite accurate really seem not to understand the nature of reality as others do who have studied physics or chemistry or other such subjects of a basic nature.

The essence of the difficulty, I think, is that human beings cannot perceive anything with certainty. Any observation humans make is imbued with error, even to observations through electron microscopes. A certain band of uncertainty surrounds all observation.

Furthermore, since the future hasn't happened yet, there are no facts about it and it is an implication from our inability to perceive events with certainty that there exists in the universe an aboslute novelty, novelty in the sense that we cannot in advance perceive it. So this vitiates the certainty of forecasts.

And business executives, by and large, have learned to understand this by experience, some of which has been bitter.

A second lesson, forecasting has for its prime purpose not the accurate portrayal of the future but the improvement of current decisions about the future.

In this sense, bad forecasts, or inaccurate forecasts, are better than none because even inaccurate forecasts make some demands on the imagination, while the absence of forecasting leaves us at peace in our dogmatic slumbers.

A third lesson that business has learned about forecasting is that forecasts affecting basic decisions impart vision to the extent that they anticipate the interaction of evolving processes.

What I am trying to say is that business executives as a matter of habit over the past 20 years have come to think in ways that respond to periodic briefing sessions which they schedule with forecasters as a part of the business routine.

As a result, the habits of mind of business executives that go along with carefully following the pattern of events and steadily trying to anticipate future events are built into business life. So business leaders have become imbued with forms of imagination and forms of vision concerning the future that are imparted by this continuous exposure to forecasting.

Their perspective also appears in sharp contrast to political leaders such as legislators who lack such arrangements.

At the State level, for example, it has been my experience in briefing part-time legislators that many seem to be essentially lacking in much imparted vision of the broad movement of economic or social events, while their business counterparts in State financial centers follow and indeed help create the patterns on the other hand.

So State legislators generally should be provided with far better economic and social intelligence briefings than are typically available to them.

In order to understand the role that forecasting plays in corporate planning, it is worthwhile to look at corporate planning. Much has been learned about this process in the last generation. Some of it is unexpected.

First: Business recognizes that corporate planning is a process, comprehensive, including the total organization, changing through time, integrated, and above all not merely the sum of the plans of operating units.

These words may not carry the realization that careful corporate planning may never eventuate in a plan. But such is the case.

What is important is illuminating people's vision in a corporation and permitting them to experience and participate in a process of thought and of agreement.

Second: Corporate planning is futuristic in the sense that it need not be bound by the past at all. It is, of course, bound by the past in the shape of the organization but every effort is made in corporate planning to escape from the past by looking at current decisions in the light of their futurity.

Third: Corporate planning is flexible and oriented to action. It is designed to encourage rather than inhibit initiative, so very sophisticated corporations end up with a plan which may be put verbally on a single sheet of paper and never published because of a fear that an elaborately written plan merely inhibits further imagination rather than encouraging it.

Business has learned some principles therefore involved in successful planning. The process of planning itself should be planned. Factfind-

ing and analysis are crucial. Planning is continuous. It should be more than a staff function. It should directly involve people affected. It should be aimed at action. It should be kept simple. It should avoid mountains of paperwork and the designation of a priesthood engaging itself in arcane or exotic exercises complete with secret jargon and floods of paper.

Forecasting is a necessary part of planning. Indeed, since its purpose is to improve the quality of current decisions, forecasting is a part of policy planning, both institutional or personal.

In the large corporation today, forecasting is being practiced on a wider and wider scale. Not only do modern corporations employ economic forecastings to carve out future markets; they also examine likely trends in technology, politics, social value, psychological, satisfactions and international or worldwide events. Social, political, technological, and economic elements are all involved in anticipating future markets for corporations because they recognize all of these elements in our society are changing.

Finally, I would say that corporate leaders with whom I have discussed the subject acknowledge that even though planning is undertaken in an intensive way, it is a principle of planning to postpone decisions as long as possible.

That is for the purpose in a corporation of avoiding error and in recognition of the sense in which events change the best laid plans.

So corporations, though they engage in an elaborate process of planning, try to keep the results simple. They try to affect attitudes of minds of people, rather than engage in enormous paper-producing processes. And they try to maintain flexibility if possible.

Now then, can futures analysis help us to choose our environment?

It seems to me that if one recalls briefly the intellectual origin of futures analysis in the writings of such people as Dennis Gabor, that he can see that futures analysis represents a highly significant change in our viewpoint concerning the nature of time and, particularly, our viewpoint concerning the nature of the future. Business firms have begun to adopt these new concepts.

I don't have the time or capacity to illustrate very much, but let's take one advanced technological firm which engages in "reverse logic-tree branching" as a planning technique. What the firm does is to gain opinions, using futures analysis, about what is to be invented 30 years from now.

Then it reverses that process, looks backward toward the present, and selects components or necessary precursors to examine for production 5 years from the present. Then it selects from among those possibilities components or devices which are best suited for the current nature and skills of the corporation.

Doing that increases the probability that the original forecast will prove to be correct. But since that forecast is based on expert opinion and understanding of the internal history of technological subject matter, that is a minimizing process or at least an error-reducing process.

I have written in my statement some implications. I imagine that the writing is loose and illustrative as to how concepts derived from futurism might affect public policy going beyond the role of the corporation.

It seems to me the effects would occur principally in respect of the organization of institutions on a nonauthoritarian basis in response to recognition of the way living systems behave; that it would be involving new attitudes and new perceptions of the role of public policy in science, technology, education, and social measurement; that it would involve new approaches to economic policy and that, to the extent the traditional political value system was accepted, we should celebrate liberty and subdue the state.

Public policy would aim at inventing means by which to do that by creating social markets for the private production of so-called public goods.

Also, it seems to me there would be a change in viewpoint concerning the role which public education plays in the society and that therefore the brilliant technology of the 20th century would finally be adapted to creating a part of the process of "anticipatory democracy" which Mr. Toffler described.

I believe the best examples for that are in Great Britain and that in particular the series by Jacob Bronowski on The Ascent of Man, and that of Kenneth Clark on Civilisation, show what could be done if resources were devoted to this kind of understanding of the role which education should play in creating civilization.

With respect to community planning, the business community has had some significant experience. One such piece of experience is the role the citizens league in Minneapolis-St. Paul has played in attempting to privatize public goods production.

That has produced a spinoff called public service options, which is hard at work in Minneapolis-St. Paul, attempting to invent new markets.

Senator CULVER. Excuse me. What does that mean?

Dr. MADDEN. I mean that the citizens league, having done a study of 2 years in length attempting to find out how private corporations might compete to produce transportation or parks or recreation facilities or other such goods which people want but which are now produced by Government agencies, there has been a spinoff from this of a little corporation called public service options. It is trying to develop a process by which to sell a more economical approach to constructing parks to municipalities and States.

It is also trying to develop a transportation system based on exploring the possibilities of carpooling.

Some of the private corporations in Minneapolis-St. Paul are beginning to provide their own transportation system because of the inefficiency and ineffectiveness of the public transportation system, and thought about the role that taxis play, the role that school buses play, the role that other buses play, raises the question whether we don't have an enormous amount of excess capacity in transportation that results from a badly organized transportation market in the cities.

Whether this will work or not, we don't know, but it is at least some fresh thought on the transportation problem that doesn't get hung up between the debate over rails versus highways and one form of massive systemic transportation over another.

It is a new way of looking at the question.

Similarly, for Dallas and Houston, two very significant cities, in respect of citywide or urban planning, goal-setting for Dallas was

headed by a business executive in a high technology industry who was familiar with corporate planning. It has led to a long-range plan for that city of some significance that is understood by a large number of citizens.

Similarly, the Chamber of Commerce in Houston has developed a long-range planning process in Houston. The late Dr. Marvin Huxley, the executive vice president of the Houston Chamber in his last public speech, before he died a year or so ago, was asked what was the advantage to Houston in knowing, as some people have claimed, more about its future for the next 25 years than any other city in the world.

Dr. Huxley gave the following answer: He said:

> When people are permitted to involve themselves in the process of choosing goals and acquire the necessary knowledge to make good judgments and find this knowledge available and organized for them and presented to them in such a fashion as they can understand it and reflect on it, then when a plan is settled upon and the city agrees in all its various components that these goals are appropriate to pursue, you find a new citizen maturity has developed.
>
> So that when obstacles arise in the attempt to achieve goals, there is not the frustration and the impatience and the terror and the anxiety which can be created when people desire to become involved but the planning process is frustrated.

I thought this was highly significant in relationship to Mr. Toffler's comments. I think the whole experience of corporate planning emphasizes the attitudinal aspect of the impact of democratic planning on people and their behavior.

I certainly would like, personally, not speaking for the Chamber of Commerce of the United States, but speaking personally, to associate myself with the notion that in the change in the culture that we are living through we have magnificent opportunities to bring to bear knowledge, organized knowledge, indeed, knowledge organized beautifully, to consider the problems which we face as a Nation, or as communities, or in smaller groups.

It is for this reason that I consider these hearings to be extremely important in a long-term sense. And I believe that they are the beginning of a most significant enterprise. Thank you.

Senator CULVER. Thank you very much, Dr. Madden.

[Dr. Madden's prepared statement and responses to additional questions follow:]











Statement of the

CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA

on: Futures Analysis & Long-Range Forecasting

to: Panel on Environmental Science & Technology of the Subcommittee on Environmental Pollution, Senate Committee on Public Works

by: Carl H. Madden

date: December 15, 1975

As the nation's largest business federation, the Chamber's membership includes over 48,000 business firms, corporations and individuals—and more than 3,500 chambers of commerce and trade and professional associations, with an underlying membership in excess of 5,000,000.

STATEMENT
on
FUTURES ANALYSIS AND LONG-RANGE FORECASTING: A BUSINESS PERSPECTIVE
before the
PANEL ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY
of the
SUBCOMMITTEE ON ENVIRONMENTAL POLLUTION
of the
SENATE COMMITTEE ON PUBLIC WORKS
for the
CHAMBER OF COMMERCE OF THE UNITED STATES
by
CARL H. MADDEN
December 15, 1975

My name is Carl Madden. I am Chief Economist, Chamber of Commerce of the United States.

ORIGINS OF BUSINESS FORECASTING

U. S. business by now has, by one way of counting, nearly half a century of experience with formal economic forecasting. Clarence Ayres of the Cleveland Trust Company in the 1920's was a business economist pioneer in calling business attention to cyclical patterns in economic activity. However, the intellectual leadership of the late Wesley C. Mitchell, professor of economics at Columbia University and founding president of the National Bureau of Economic Research, lies behind many present-day techniques.

The eccentric genius Thorstein Veblen (1857-1929) was Mitchell's mentor. Veblen, learned in philosophy and the new social science of anthropology, vigorously criticized the "theology"--that is, the dogmatic assumptions--of much economic theory. He urged, instead, an approach far more modest and empirical, that would concentrate on observing changes and trends in the major institutions of society. Veblen introduced the idea of evolutionary change into American economic thinking.

Mitchell brilliantly and doggedly carried out Veblen's mandate, as it applied to understanding the business cycle. At one time, and before computers, Mitchell and a few modestly paid colleagues patiently collected and followed the behavior of some 8,000 economic time series, in order to see what happens during a business cycle. But Mitchell's vision of what he was trying to do ranged far wider than the business cycle. As he said in the

Annual Report of the National Bureau of Economic Research as early as 1921:

> "Our best hope for the future lies in the extension to social organization of the methods that we already employ in our most progressive fields of effort. In science and in industry...we do not wait for catastrophes to force new ways upon us... We rely, and with success, upon quantitative analysis to point the way; and we advance because we are constantly improving and applying such analysis."

By 1944, despite the proselitizing efforts of Clarence Ayres, only eight business economists were at work in U. S. corporations. But the Keynesian revolution in economics during the 1930's was preparing opinion in business to recognize the value of forecasting. Keynes, among other things, rediscovered the forgotten identity between the current monetary value of a nation's output and of its income generated from producing the output. This fundamental accounting identity, "dollar-output equals dollar-income," gave the basis for developing national income and product (output) accounting, the source of today's familiar "GNP" (gross national product) statistics. The National Bureau of Economic Research and Nobel laureate Simon Kuznets led in the development of national income and product statistics.

Since 1944, the number of economists working in U. S. business has grown from eight to between 3,500 and 4,000 in 1975. Passage of the Employment Act of 1946 followed vigorous debate that drew economists into such organizations as the Chamber of Commerce of the United States. These economists, notably the Chamber's Emerson P. Schmidt and George Terborgh of the Machinery and Allied Products Institute, played a highly important but little appreciated role in setting the social and economic environment of the post World War II period.

These economists gave intellectual leadership to the refusal by business and its allies among the public to accept the central economic planning concepts of the original Full Employment bill of Senator Murray of Idaho. They vigorously disputed the pessimistic views of the neo-Keynesian "stagnationists." Leading academic economists and followers of Keynes were convinced of the long-term decline ahead for the U. S. private economy. They thought they foresaw that inventions would be labor-saving rather than industry-creating, that the geographic frontier's disappearance would limit geographic expansion, that a population becoming stable would limit demand.

Business and its economists attacked such ideas, what Terborgh called "The Bogey of Economic Maturity," in a book few academic economists were willing even to review. They helped achieve a more moderate mandate in the Employment Act of 1946 than what was proposed by Senator Murray.

U. S. business has found economic forecasting useful. It has been useful partly because the Employment Act of 1946 has been the cornerstone of national economic and social policy. The Act assigned the federal government responsibility for creating and maintaining the conditions under which people able and willing and seeking to work could find useful employment. It decreed that the federal government should use "all its plans, functions, and resources" to fulfill this responsibility. Although the term "full employment" was deliberately deleted from the Act, the Employment Act in fact did make "full" or "high" employment the primary goal of national economic policy in the postwar United States.

However, even as it was intended to commit the nation to full employment, the Employment Act of 1946 was also intended to limit government intervention into the economy in the name of full employment. The Act does not give the government carte blanche. It does not specify means. It does not authorize government goal setting. It does not obligate the government to those who are "able and willing" to work but only to those who are "able and willing and seeking" to work. It specifies "useful" employment. It requires in its execution consistency with "other essential considerations of national policy," including as generally acknowledged some tolerable degree of price stability. And the Act directs the government to exercise its responsibilities in ways that "foster and promote free competitive enterprise and the general welfare." Though vague and open to wide interpretation, such provisions limit federal intervention in the market economy, substitute bureaucratic for market evaluations, or replace private sector economic activity.

The predominance of the market economy has made economic forecasting in U. S. business more reliable than in its absence because the calculus of market behavior has underlying patterns of stability based on a well-studied logic. Political developments, by contrast, are notoriously more difficult to forecast.

LESSONS FROM BUSINESS FORECASTING

Business experience has much to teach us about forecasting.

1. One lesson of crucial importance is that the art of forecasting will probably forever remain imperfect; only fools and charlatans claim otherwise. The lesson is indeed of crucial importance because it is only part of a grander and more humbling truth, that humankind may seek knowledge but the nature of reality precludes its finding certainty. The undoubted best portrayal of the broader truth to the lay mind is the TV classic, the Ascent of Man by Jacob Bronowski, especially the episode "Knowledge and Certainty." The reason that knowledge cannot eventuate in certainty is that perception, even at its most precise, is inextricably tinged with error and uncertainty--this is the profoundest lesson of humility imbedded in the triumphs of modern physics.

The only reason to attach the qualifying "probably" to the statement that forecasting will remain imperfect is that we cannot even be certain that our knowledge of perception will forever remain in such a state as to yield conclusions consistent with present ones. However, there is no basis whatsoever in the demand for certainty in respect to any form of knowledge, including forecasting. Dogmatic faith of true believers should lie in the realm of individual belief and not in political movements, as the violent history of the twentieth century all too well records.

2. Forecasting has for its prime purpose not the accurate portrayal of the future but the improvement of current decisions about the future.

Here is another crucial lesson business has learned about forecasting: bad forecasts are better than none. The reason lies in the nature of forecasting logic. In essence, a forecast is a logical or intuitive exploration of an interacting set of hypotheses. In less scholarly language, a forecast is an exercise in ingenious guessing.

Bad forecasts are better than none because even bad forecasts make demands on imagination, while no forecasts leave us at peace in our dogmatic slumbers. But, of course, "bad" in this meaning is restricted to "inaccurate." Looking back to the "stagnationists" and their "bad" forecasts, one sees the source of error mainly in the stagnationists' narrow and ignorant view of science and technology in its relation to economic activity, rather than in a form of inaccuracy linked to minor relationships.

3. Forecasts affecting basic decisions impart vision to the extent that they anticipate the interaction of evolving processes.

By now, business and financial leaders are often technically educated in some analytical field--law, engineering, science, management, or economics--at the graduate level. Not only is it more and more true that these leaders are "brought up" on methods of inference in modern statistics. They also understand more frequently at a significant level of depth the role forecasting plays in decision-making processes and methods.

As a result, business leaders are more and more often well-informed about domestic and international economic and financial institutions, trends, developments, and problems. Sources of information in business are far more readily available and timely than ever, from the Wall Street Journal, now the second largest daily circulation newspaper in the country, to new world-wide private news and intelligence services offered by world-wide banks.

What's more, in major industrial and financial corporations, periodic "briefing" sessions for top executives and staff are a part of the business routine. As a result, the habits of mind that go along with carefully following the pattern of events and of steadily trying to anticipate future events are built into business life.

Business leaders therefore recognize and become imbued with forms of imagination and of vision concerning the future that are imparted by continuous exposure to forecasting. Their perspective often appears in sharp contrast to political leaders such as legislators who lack such arrangements. At the state level, for example, it is not unusual for part-time legislators to be essentially lacking in much imparted vision of the broad movement of economic or social events, while their business counterparts in state financial centers follow, and indeed help create, the patterns observed. State legislators generally should be provided with far better economic and social intelligence briefings than are typically available to them.

THE ROLE OF FORECASTING IN BUSINESS PLANNING

Modern corporate planning to produce goods and services people and other businesses will want, can afford, and will buy, is highly developed. Forecasting is an integral part of the process of planning. But to understand how, something about corporate planning itself needs to be understood.

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First, corporate planning is a process. It is comprehensive, it includes the total organization as it changes through time, it is integrated and not merely the sum of the plans of operating units. These words may not carry the realization that careful corporate planning may never eventuate in "a plan," but such is the case. What is important in illuminating people's vision in a corporation is experiencing and participating in the process of planning. A "plan" itself is of little consequence for long.

Second, corporate planning has a long-range dimension; it is not oriented merely to the past and present but to the future. Such planning results in current decisions being made in the light of their implications to the future--their futurity--rather than being dictated by past trends extrapolated or by current pressures. Indeed, it is the experience of self-involvement in the planning process along with others that allows for agreement on constructive objectives aimed at the long-range future.

Third, corporate planning is flexible and oriented to action. It is designed to encourage rather than to inhibit initiative. For reasons of flexibility, corporate planning seldom eventuates in comprehensive plans that only have to be changed. Instead, it eventuates in attitudes of mind, in common understanding of goals, in specific innovations, in a sense of direction. It should be recognized that, just as the process of planning stimulates acts of envisioning new possibilities, so the existence and promulgation of a plan constrains such acts. A plan is a device that inhibits further imagining. And, as the poet observed: "The best-laid plans of mice and men gang aft aglay."

Business has learned some principles involved in successful planning. The process of planning should itself be planned, to establish its role. Fact-finding and analysis are crucial to the process. Planning is continuous, is more than a staff function, and should directly involve people affected by planning decisions. Planning should be aimed at action--at goals of specific meaning and content. The process has to be kept simple; it is aimed at affecting the perceptions of people and not at generating useless mountains of paperwork. Above all, making planning an arcane or exotic exercise in a priesthood, complete with secret jargon and floods of paper, will destroy its effectiveness.

Forecasting is a necessary part of planning. Indeed, since its purpose is to improve the quality of current decisions, forecasting at its best is a part of policy planning, institutional or personal. In the large corporation, forecasting is being practiced on a wider and wider scale. Not only do modern large corporations employ economic forecasting to search out future markets; they also examine likely trends and changes in technology, politics, social values, psychological satisfactions, and international or world wide events. Social, political, psychological, technological, and economic elements are all involved in anticipating future markets for corporations operating in today's and tomorrow's changing world environment.

FUTURES ANALYSIS AND PLANNING PROCESSES

Futures analysis already is beginning to play a more significant role in the corporate planning process and in community planning processes. The role of such analysis, depending on the quality of scholarly understanding and competence that it represents, is likely to and ought to grow.

This is not the place to discuss the sense in which the present scope of change in society represents the displacement of the existing culture* and development of new culture. Futurism as a way of looking at forecasting is an effort to develop tools of such new culture.

The central concepts in every one of our modern disciplines, sciences, and arts are no longer isolated objects existing in abstract and absolute time and space, but are patterns and configurations. They are all new concepts of a whole, of a set of interacting relationships that can only be understood as a whole. Indeed, the parts in any pattern or structural configuration can only be understood and appreciated in contemplation of the whole.

Futures analysis conforms to such insights. Rather than extrapolating trends ahead in a single dimension, futures analysis defines the future as a logical set of infinite possibilities. In principle, as argued by Nobel laureate Dennis Gabor, futures analysis proceeds to examine alternative sets of possibilities--"alternative futures"--and their implications and to make possible the exercise of choice regarding the kind of future desired. In this way, futures analysis allows us to "invent the future."

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*cf. Carl H. Madden, Clash of Culture: Management in an Age of Changing Values, National Planning Association, Washington, D. C., 1972

Business firms use these concepts in corporate planning. For example, an advanced technological firm engages in "reverse logic-tree branching" as a planning technique. That is, the firm gains opinion estimates by experts of what device may be invented 30 years into the future. The firm retraces the process, asking itself what would have to be invented five years into the future, if the 30-year forecast were to be realized. Examining the five-year requirements, the firm chooses to build and market the component that best fits in with the firm's skills and markets.

But more than that, modern corporations--which, after all, are the subject of intense and professional study in the nation's business schools--are themselves shaped and managed by new ideas such as those of futurism. Many of the leaders in the futurist movement have been corporate planning executives.

The impact of futurism, as the subject relates to the present adaptation to a new culture, is far broader, however, than suggested merely by its impact on corporations. The impact extends to our way of conceiving of life itself and our role in it.

One powerful interpretation--powerful because it is linked to the modern adventure of knowledge since the mid-nineteenth century--is "living systems theory." It assumes that the appropriate way to look at processes is as living systems.

Everything in such a system is interactive, with continuous circular causal trains of amplifying and damping feedback; the boundaries are dynamic. Also, living systems are continuously receiving new inputs from their environment and they are therefore classified as open systems. Next, every organism in its environment continually transforms every other; every living organism is spontaneously active and autonomous; self-initiated action is its most fundamental characteristic. Therefore, life is primarily a dynamic process, sustaining itself in dynamic equilibrium, and structure is generated from the history of this process, and in turn, influences but does not determine the potentialities for future changes.

Living systems are everywhere observed to evolve spontaneously, transforming themselves by way of progressive differentiation from states of lower to higher complexity. The distinction between more and less complex living system rests on increases in order, or used information. The processes

by which these systems change over time can be generalized as evolution. These systems are purposeful or goal oriented in their functioning and behavior. They tend to be organized in progressively higher levels, or hierarchies.

Groups of such systems interact dynamically with each other and with the environment. There are a variety of qualitatively different kinds of interaction possible. All living systems show processes of growth, either accretive, replicative, or mutual. And, finally, there is much to be learned about goal seeking mechanisms and behavior and regulation to maintain dynamic stability in the new science of cybernetics.

If one were to ask what changes in management of various institutions in the society would likely occur if there were a concentrated effort for the society to use and to explore, and if you will, to celebrate the new perception of reality, then I would offer these changes generally. They constitute two different ways to perceive organizations.

Now then, what are some of these characteristics of the future organization? The organization is not designed and built, it is evolved; and it grows in an open-ended and indeterminate process. It does not get organized by its leaders and managers; it is self-organizing and self-adaptive. It's not defined by its structure, functions, and boundaries nor can it be thought of as real and free standing; it's fluid, dynamic, and changes in living interaction with its environment. It does not have a rigid and well-defined structure; it has a changeable and changing structure. Parts of the organization cannot be analyzed and treated independently; everything interacts with everything else.

Things do not happen by changes in linear cause and effect; they happen through dynamically interactive effects of positive and negative feedback. Relationships do not tend to be firm until consciously changed--they're always changing. Future performance cannot be simulated by continuous function computer models--it can only be analyzed by pattern analysis and discontinuous sets. The organization cannot be assumed not to have unintended side effects--it does have side effects, and the term "side" begs the question of the nature of the effect. Management is not organized through command, direction, and authority; but by responsibility, influence, expertise, creativity and process design, and is accomplished not by formally defined decisions but by finding and pursuing goals, initiating open-ended processes and the like.

But if one were to have a society of social innovation which was managed in sympathy for and in concert with some of the ideas I have sketched out here, then I think things like this would happen: Government would create new policy in support of science, environment, energy, social measurement, education, and economic policy consistent with the goals of the new culture. And those goals are naturalism, holism, and immanentism.

I think our policies with respect to science, technology, education, social measurement and economic policy need fundamental revision, and I think one can see this in the speeches of Arthur Burns, of people like myself and of many others who are dissatisfied with neo-Keynesian macro-economic principles, but more than that, are deeply dissatisfied with the whole structure of economic policy as it now exists, and so we are interested--people like me at least--are deeply interested in the contributions of Jay Forrester and his group to a better understanding of the dynamic system effects that he is beginning to portray.

Government would set new priorities to create social markets for private business operation by massive abandonment of outdated and inneffective social welfare and industry subsidy programs. And so, perhaps William Buckley was correct when he said that we need to "celebrate liberty and to subdue the state." But if we are to do this in an urbanizing, industrializing society, we cannot do it at the expense of public goods. Indeed the message of the new economics is that we must produce in two dimensions--both the input and the waste dimension--more adroitly and elegantly than in the past. So I submit that social markets, whether for private profit organizations, or non-profit organizations, may have more flexibility and more effectiveness than further bureaucratic efforts to supply these goods.

Government would initiate broad measures to achieve government suburban regions consistent with social and economic reality. A national network of combined urban observatory development banks, having a private federal development bank at the center--in order to analyze and finance urban innovation--would restructure economic policy consistent with environment and policy science insight; would restructure science and education policy to create wealth, and to achieve enormous economies.

Business would adapt market planning to study of the future, and the goals of the new culture, and would create performance-oriented corporate markets in powerfully attractive fields such as high technology goods, mass communications, and new services. For some, a commodity can be seen as the epitome of a Newtonian concept; an object existing alone in absolute time and space. But more and more, we can think of fundamental needs of human beings and of systems by which to meet these needs.

So recycling of durable goods rests on the invention of markets for services rather than for products, which give incentives to producers to achieve durability. I don't consider that at all outside the bounds of the ingenuity of the American corporation. On the contrary, it is attractive and challenging. It is simply a matter of the vision and imagination, and the initiative and the risk-taking to pursue that kind of marketing revolution.

Likewise, business would redefine balance sheet concepts of social responsibility and market performance, to abandon the style of bigger and better. This move is also consistent with providing services and maximizing the provision of service, rather than maximizing the number of units of product. So, it is consistent for the corporation to pursue social responsibility. The corporation would attempt to achieve product minimization, zero defect reliability and durability, and create new wealth through expanding opportunities for private production of public goods, through creation of new and unforeseen public goods, and through generating the new invisible wealth of knowledge, beauty, education, travel, cultural growth and health improvement.

Business would markedly increase its investment in policy science research to achieve a positive anticipatory role in implementing government measures. The future "Washington rep.," in this context, would be a scholar; he would organize means by which the technically expert in corporations would participate with technical experts from other sectors of the society in designing legislation long before it reached the floor of the Congress.

Business would support and help frame government policies, allowing for simultaneous attack by the society on all fronts to achieve the promise of the first post-industrial society for the good life domestically and peace and cooperation abroad. We have not really centered on the magnificent,

positive, possibilities for the United States of America here at home, tending to its own business, to develop the highest form of civilization of which it is presently capable. We have had the pomposity of the Great Society and the New Frontier, and what the British little girl singer calls so beautifully, "all that ja-a-aaz" but we have not had leaders who have made us aware that we stand uniquely in a position of creating the continuous revolution. It would seem to me that it would create wealth in business, for business wholeheartedly to cooperate. And I think leading business corporations are doing this.

Business would take vigorous leadership in applying real science to social affairs by re-thinking its role in full support of new measuring systems such as technology assessment, social indicators, and the like for evaluating social responsibilities of all institutions. Business might sponsor a proposal that the Congress should prepare an economic and social impact statement to accompany every major piece of social legislation that is introduced in the Congress. Business might support a staff in the Congress of policy analysts who would be one route by which such examinations would occur. That might be more effective in the long-run interest of the free enterprise system than an approach which derogated an effort to make policy analyses in advance of legislation.

A communications policy and philosophy in the nation would be directed toward integrating art and knowledge resources to make comprehensive understanding widespread and a source of social cohesion. The best three instances I can offer are British. One is the odd career of Lancelot Hogben, the author of Mathematics for the Million who also wrote a seminal book on multi-media art; and Jacob Bronowski and Kenneth Clark as exemplars of Hogben's theory, with their classic productions, The Ascent of Man and Civilisation.

Finally, education would become a powerful new growth industry available for competition as between government and private educational means. The notion that we are in for some kind of period of decay on account of having a larger number of educated people in the future than in the past seems to be a form of obscenity. If the imagination of the civilization is so puny that it looks upon increasing education as a danger rather than an advantage, why then I think it's time to question its leadership.

FUTURISM AND COMMUNITY PLANNING

Business has exercised leadership in many ways, trying to bring to bear new concepts associated with our new knowledge into the processes of community development. The most recent statement by the Chamber of Commerce of the U. S. is its publication, Managing Urban Growth: An American Policy Dilemma. The idea lying behind business efforts is that of "total community development." And total community development is, to oversimplify, the application of ideas in corporate planning to the acknowledgedly different arena of the community.

The dilemma in managing urban growth is seen in splintered government unable to meet the needs of the total urban community. It is a failure of will and imagination in government. Some escapes have been made from the dilemma, but they have occurred mainly in Western urban areas where cities have been able to follow people into suburbs by maintaining jurisdiction or influencing policy. The Citizens League in Minneapolis-St. Paul developed from such efforts.

Its "story" is worth study and reflection. The League developed a citizens' participation process. It prepared analyses of regional issues. In his recent book Vital Signs, U. S. A., John Fischer, former editor of Harpers Magazine hailed the Metropolitan Council developed by the Citizens League as "a new kind of metropolitan government."

Goal-setting in Dallas, led by businessman-mayor Erik Jonsson, founder and chairman of Texas Instruments Corporation, is another example of how the planning ideas described here as applying to corporations can be adapted to communities. The story is superficially familiar. But the process developed by Jonsson deserves careful study. Of course there are other examples impossible to cite here because of limitations of time and space. The process is not everything; planning efforts can fail and have failed. However, the ideas of living systems as adapted to community development efforts show great promise.

FUTURES ANALYSIS, NOT CENTRAL PLANNING

Futures analysis is not central social and economic planning. This is not the place to challenge the thesis of J. K. Galbraith in his New Industrial State, but the thesis is misguided. Corporations do not control markets in the United States. If anything, as careful studies of Solow, Weston, and others document, the scope of competition in U. S. and world markets--where competition includes not only price but service, technology, and other dimensions--has increased in the post-World War II period.*

Therefore, those who claim that the market no longer serves to allocate resources are misguided. Indeed, few propositions in political economy have proven more disastrous in terms of both economic betterment and basic human freedoms than the belief in the desirability and necessity of widespread intervention by government in economic decision-making. It is not the private economy, but government itself, that has failed in recent years.

What's more, even if it were to be granted that power concentration frustrates market behavior--a position lacking empirical support--it is a non sequitur to deal with such supposed concentration by the ultimate of concentration of power, namely central economic planning. As Newsweek, December 15, 1975, reports in a cover story on "Big Government," more and more leaders across the political spectrum share the growing public alarm over the mess big government appears to have gotten itself in.

Central planning is not a new idea. Where tried it has not worked well, even in authoritarian societies such as the U. S. S. R. once production rose above the ability to provide bare necessities. The issue of central planning is not technical, it is political. Forecasting connot be relied on to allocate future production because forecasting is too error-prone. What's more, central planners plainly tell us that they want more power. They want planning by them, for us. They want us to let their conscience be our guide. To decide, as they want to, what are our social priorities, how to rationalize production, and where to redistribute income, is to use Orwellian language. Translated, it means they want to decide what we should want, where and how we should work to produce it, and how much of what we earn we should give to someone else.

* Note National Chamber statement on S.1167, Industrial Reorganization Act, to Subcommittee on Antitrust and Monopoly, Senate Committee on the Judiciary, May 8, 1973.

The issue concerning planning is not that of central economic planning versus no planning. The issue is vastly different from this. The issue is how the political process can create an environment in which the people of the United States and the world can shake off ignorance, can involve themselves as independent human beings in cooperative processes of bringing knowledge to bear on future choices and in reasoning together to create the future environment people themselves, not planners, want to live in.

RESPONSES FROM MR. MADDEN TO SUPPLEMENTAL QUESTIONS FROM SENATOR CULVER

Question 1. Does a forecast have to be accurate to be useful?

Answer. No, Forecasts are hypotheses as a matter of logical necessity. All forecasts can be reduced to the logical form, if A, then B. In economics, some of the most useful forecasts later prove to be inaccurate because action generated by the forecast is taken to avoid its consequences. Present forecasts concerning the energy shortage and concerning limits to growth represent such cautionary anticipation of the possible adverse future events, which can be avoided better for the very reason that present forecasts warn against them.

Question 2. Should forecasting studies be done by the Federal Government, particularly the Congress, or is there a possibility that they will become self-fulfilling?

Answer. There is some genuine mystery here, mystery concerning the relationship between determination or will, on the one hand, and determinism or predestination, on the other. Determinists would hold that "what is to be, will be." Whatever Congress studies, before dismissing such determinism, it is worth reminiding ourselves that Marxist economic theory finds the decline of capitalism "inevitable" on deterministic grounds. Overwhelming evidence of modern science denies determinism, and though the evidence of science stops shortof "freel will," it surely allows for both novelty in events and for determination as being real. Therefore, the key caveat about studies by Congress or the Federal Government forecasting future events is that such studies never be permitted to gain a monopoly over competing views. In some cases, forecasting by government should indeed result in self-fulfiling prophesy; in others, not. The guiding principle remains that of John Stuart Mill, in his *Essay on Liberty*, setting the basis for individual freedom of thought and opinion in promoting mental wellbeing and reducing error. Government forecasts, yes; but, a plurality of forecasts to prevent belief from becoming prejudice, and to allow freedom of thought as a form of competition to increase the production of truth.

Question 3. At the recent Limits to Growth Conference in Houston, Texas, you stated that the organization of the future is not designed and constructed, but it is self-organizing and adaptive. If this is the case, is it possible for long-range forecasting to play a useful role in policy determination? If so, how?

Answer. My viewpoint calls for recognizing that an organization ought to be viewed as an evolving and developing whole, having its own dynamism. By contrast, the textbook way of thinking about an organization derives from static and abstract ideas of a structure that go back to 18th century ways of thinking. An organization is itself a living organism maintaining its balance in the midst of becoming and change. Today's multi-industry and multi-national corporations can have 50,000 or more employees and can be involved in twenty different industries with hundreds of product lines and thousands of product varieties being produced in fifty or more plants in ten or fifteen countries and marketed through distribution systems in twenty developed countries and thirty to fifty developing countries, each with its own local tastes and desires. Tens of thousands of purchase and sales transactions may occur every day in scores of currency and credit arrangements. Clearly, the senior managers of such a corporation are engaged in managing complexity itself, and effective autonomy has to be built deeply into the organization. When the company appears to be operating well, senior management can turn from maintaining short term stability to considering long term threats, options, and directions.

The way that long range forecasting plays a useful role in determining policy for such an organization is to open the minds of management to the contours of external change—technological, social, political, and economic—and, by doing so, to infuse leadership with vision, especially vision about positive uses of future resources. The analogy with the Congress and the Federal Government is perhaps not exact. However, the political leader can seldom go further in proposing courses of action than the common understanding of a people. Broad public awareness of future possibilities that can be created through more Congressional study of long range issues, would allow political leaders to more easily unfreeze people from their immediate situations and to move the society toward adaptation to new goals and values with less prejudice and ignorance.

Question 4. What should be done to overcome the tendency to neglect forecasting in public policy analysis?

Answer. Method is the key to influencing autonomous individuals. The oversight provision is a billiant device for inculating method in Congress. Every standing committee should hold long range forecasting hearings and produce its own studies. Governors of the states should be urged to do the same for state executive and legislative units. From the viewpoint of a well-briefed corporation executive or top banking executive, the relative lack of awareness about broad social and economic trends among state legislators is appalling. It can be a shock to an economist to discover that many legislators in his state seem not to have the faintest idea about how general trends in the international and national economy impact on the economy of the state or about how the regions of the United States compete with one another for national shares of the income, wealth, people, industry, and culture. Lacking such an understanding of how the society and the economy function, political leaders of narrow and legalistic backgrounds can easily be victimized by all sorts of prejudiced opinion, ranging from the left to the right of the political spectrum.

Question 5. In the short term, how can a public official ever see the advantages of long range forecasting?

Answer. Perhaps the short term appeal to a public official about the advantage of long range forecasting is the appeal of personal survival as a public official

Senator CULVER. Our final witness today is Dr. Amitai Etzioni. Dr. Etzioni is a professor of sociology at Columbia University. He is director of the Center for Policy Research, Inc. He is the author of such books as *The Active Society*, *Modern Organizations*, and *Genetic Fix*, which was nominated for the 1973 National Book Award.

It is a pleasure to welcome you here, Dr. Etzioni. Please proceed with your summary.

STATEMENT OF DR. AMITAI ETZIONI, PROFESSOR OF SOCIOLOGY, COLUMBIA UNIVERSITY AND DIRECTOR, CENTER FOR POLICY RESEARCH, INC.

Dr. ETZIONI. Thank you, Senator Culver, for the opportunity to be here.

I will submit my statement for the record and I would like to deviate from it for a few brief comments. [The statement appears at p. 78.]

I very much agree with the presentations before me which indicated the great significance of your effort in this area.

I believe it is of great importance, your effort in this area. In my judgment, the Nation has a tendency to stumble into the future, not to understand where it is going. This is not accidental but built into the institutional fabric and would require a large effort of the kind which I believe you have started to get the Nation to be more aware of where it is going and to less blindly proceed in a sort of semidarkness.

I would like to illustrate our present insensitivity to the future by one major decision I believe the Nation is tumbling into. I hope your efforts will help us to be more aware of what we are getting into.

A decision I believe we are making these days—I should say next year, for this year is practically gone—is basically between a return to the 1880's and 1890's versus a commitment to a quality-of-life society. Faced with economic pressures and the energy crisis, one suggested reaction is to return to the period in which we prepare the resources necessary for materialistic industrial society.

The 1870's, 1880's, and 1890's was a period of opening up the mines, laying the railroads, drilling for oil—a period in which we built up the resources. And it was also a period in which these considerations took first priority.

Then we see the options we face now, where people talk about starting a $100 billion energy corporation, a $700 billion investment over the next 10 years. That is the present estimate. We must assume that, when actual expenditures come, they will be about 2½ times as much because that is about the ratio of error when people are selling things and the estimate of what they are going to cost.

What that means is that over the next 10 years we would take all of our disposable resources and commit them to the strengthening of industrial machinery and in the process cut other things.

So the same people, who these days favor a return to what might be called hyperindustrialism, without expressly making an option clear, suggest we cut all the other programs which move toward a quality of life society.

So, specifically, they would like us to slow down all efforts to cut pollution and protect the environment by phasing out, by going slower, and so on. They don't want to have consumer protection laws because they say this is going to increase costs.

I think they are right. Better consumer protection in part will save lives and has some economic benefits, but it also has some costs. The occupational safety law again exacts some costs, especially from small businesses.

In all these areas—environment, consumer protection, worker protection, affirmative action, accounts to medicaid, food stamps—we get a signal that we should trade off, in effect slow down in these areas, and favor resources to build a bigger industrial machinery up to 12 years from now. It is widely agreed that the major payoffs are years away.

If the American people would be given a clear choice between a slowdown, a cutting down of all our human problems programs from justice to environment protection, from consumers to workers in favor of a greater infrastructure, then I think most American people would know what their choice is.

But we are not presented with these clear alternatives. We are told of each single item as it is presented, and, as a result, the accumulistic significance of these decisions—cutting the food stamps here, thinning out medicaid there—is hidden.

The alternative is to have a society which is less capital intensive, less energy intensive, and realize other satisfactions not derived from material goods, such as the satisfaction derived from a greater cultural, public affairs, interpersonal activity.

So our hope is that some mechanism of identifying clearer futures alternative will pay particular attention to this major decision.

My testimony does not give this illustration because I knew that my colleagues would precede me and talk about the major issues, so I thought I could possibly make a contribution by dealing with some of the more technical questions, of what it takes to put together an as-powerful-as-possible future reaching machinery.

So let me just briefly mention some of the major themes which in my judgment would go into this effort. In many ways, I cover in my

testimony such things as Mr. Gordon and my colleagues have already spoken about.

First of all, briefly, I would favor that the study of the future should not be segregated from the study of the present and past; this will give future studies a safer anchoring.

Let me give you a quick example. Somebody comes and says, as people do say, in my judgment, correctly, that the best way to deal with energy questions is on the side of conservation and not on short-run crash projects to develop new energy sources. We could cut some of our uses of energy while new developments are at least 5 years down the road.

But if somebody comes around and says we could cut, over the next 2 years, our use of energy by 15 percent, I would like to know if anybody in the past had ever cut anything significantly, especially in the energy area, or if the greatest cuts were 2 percent? That does not suggest to me that if in the past the largest cuts were 2 percent, it is not conceivable and possible to achieve 15 percent next year. But it gives me a different sense of reality, than if there had been 15 percent cuts in 1954 or 1956 or some other past year.

Or if I knew that in the last five public education campaigns—and the public education campaign regarding energy conservation suggested is no different from the five we used to fight drug abuse and alcoholism and smoking and achieved few noticeable results—I would be more cautious.

One of the best ways of giving futures studies a reality testing, reality quality, is not by copying the past but including an understanding of the past and suggesting to what extent we built it, to what degree we hope to surpass it.

Second: I think a person dealing with the future must have the right to at least anticipate certain factors. The future shouldn't be, and we should not allow it to be, a replay of the past.

That would be tragic. I think we should explicitly state when we expect new factors to enter. Since the best prediction of the future is what has been in the past, so if you predict otherwise I think you should explicitly state that you are deviating from past predictions and what your reasons are for believing this time around Congress will listen, that this time around the war budget will be cut, and so forth.

Third: I believe we need, very carefully, to separate the heuristic futures from forecasts. We tend to mesh the two together. By heuristic futures I mean alternative futures which we do not expect will come about but we discuss them to give us an insight, a feeling about the things we may wish to pursue.

For instance, I could imagine in discussing heuristic future what would happen if no cars were allowed into Manhattan. It could be a very useful mind-broadening, maybe boggling, exercise to give us a feel for a holiday from cars.

Now, I don't think I would predict that removing cars is going to happen, but I would think it very essential for a good futures study to deal with such imaginative alternatives.

The only thing I would ask for is that there be a little flag or marker or color, say, in the upper left-hand side of the study, to tell us when we are predicting that something is going to happen or when we are saying that that is something we would like to see happen.

The significance of the difference arises in the next point. We have to ask the question, not only to what degree we can read the future but to what degree we can manage it? Which is not one and the same thing.

If we are very modest and we believe to a very large degree the future is already predestined and predetermined although it can be edited here and there, then of course there is interest in heuristic futures.

You are more interested in what is going to happen, if you are less modest and believe we can shape the future to our specifications. In that case we should have less interest in forecasts; what does it matter, if we are going to change it?

So the questions are of intensity in our capacity to manage the future which is very important for the balance between heuristic futures and forecasts.

I personally belong to those who believe that at least for the short-run, 5 or 10 years, our power is relatively small and the future is relatively given. Therefore, I personally am somewhat more interested in forecasts and somewhat less interested in heuristic futures.

I fight for the right for people to make heuristic futures. It is a question of balance. I wish we would have somewhat more forecasts and somewhat less wishful thinking.

To move on, I am very grateful to my colleagues for coming here to deal with the long run future. I think it is very important. Today we are so occupied with how New York City is going to pay its bills 2 weeks from today and what New York State will do tomorrow and on the national level what is going to happen in the next election and so on, that people forget there are major longrun considerations.

People have talked about this and I wish to take nothing away from them. The only thing I wish to add is that one of the best ways to respond to this in the long run is to deal with the short run. If you cannot predict or forecast—I am fully aware of the distinction—what is going to happen 3 years or 6 years from now, I am not completely confident that we can deal with the year 2000 in a sufficiently precise manner.

I would like to remind people about the stock market. It is an excellent system to study. The market has daily quantified readings on the computer. It deals with quantitative variables, not qualitative variables, things which have precise numbers on them, and it is easy to study as compared to things such as people's feelings, values, environment, and the Russians.

The price of General Motors stock is an extremely simple event. As we know, there are studies which have proven again and again that total ignorance is a better predictor of the future than what at least half of the experts have to say.

One last example: Chess, as those of you who play know, is an extremely simple game compared to the future. We have only two players. In the future, God knows, how many there are. There are 64 squares, not 63 or 65, all exactly divided, half are white and half are black. The turfs, the lines are very clearly marked. Where is such distinction between the city and the State and the region? In chess the information is all there. You can see where each piece stands. You just have one look at the board and all the pieces are there. The rules of the game are absolutely explicit and have not changed for hundreds of years. In spite of all this—a very simple situation, two players, the pieces all there, each guy getting one move in his turn—

we know that planning the moves of chess is an extremely difficult business. The most highly powered computers cannot come up with a solid plan and we use intuition, guessmaking at an art as our best way of playing chess.

I would like us to balance our commitment, to probe into the future. It is absolutely essential so we don't get locked into the present with these attempts to test our capacity to deal with the future by dealing with the 3 years and the 6 years.

Let me close by saying that I am saddened that we don't have yet—and Mr. Gordon obviously started it—a credit system for future experts. We have it for bonds. You can get a rating on a bond: 3–A, 2–A, and 1–A, which is a prediction about the future.

The three A's tell you that this bond is more likely to pay interest and capital in the future than a 3–B bond. Similarly for restaurants, we have stars which tell us about restaurants and the likelihood of getting a decent meal.

If you go to a horse race you can get a poop sheet telling what the horse did in previous runs. In surgery and futurology it is not possible to get a credit rating on the past performance of the surgeon or the futurologist.

Because of this situation, experts are called in, not on the basis of their talent and performance, but on the basis of the other considerations.

Experts are called in, because like the false prophets in the "Old Testament," they testify to that which a king wants to hear. Experts are called in because they are charming or bring out the media. They are called in because they are of the correct wing of the desired party.

For instance, one of the very few persons who correctly predicted the energy crisis to the finest details is very rarely seen in these halls, because he is not a charming, delicate person.

But the persons, who got us into the war in Vietnam, advised the colleges to move from investment bonds to stocks just before the stock market collapsed, and urged New York City to decentralize its school systems, are called upon regularly to testify and advise the powers that be.

I hope you will soon have a retrieval system of past predictions so that future science will be helped to face its past failings and will help congressional committees, Senators, and Congressmen rely upon proven experts, and draw upon those—nobody is going to have perfect forecasting—who stumble less often. Then we can proceed upon as reliable a basis as possible for our future's sake.

Senator CULVER. Thank you very much, Dr. Etzioni.

I was interested in your suggestion of not separating the evaluation of efforts toward forecasting from the past and the present. When you suggested that we should review the empirical evidence involving similar efforts in the past, I couldn't help but recall in 1954 I had occasion to be in a bistro in Paris and it was at the time Mendes France was trying to urge his French compatriots to drink less wine, a major public education effort to combat alcoholism.

There was a sign on the wall which said, "Beware, wine kills slowly." Some French wag had written beneath it, "That is all right. I am in no hurry."

I don't know what weight you might give to that campaign, but it perhaps is a useful reminder.

[Dr. Etzioni's prepared statement follows:]

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A Statement For Hearing On

"FUTURES ANALYSIS AND THE ENVIRONMENT"

Before The

PANEL ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY

SENATE SUBCOMMITTEE ON ENVIRONMENTAL POLLUTION

Monday, December 15, 1975
Public Works Committee Hearing Room
4200 Dirksen Senate Office Building
Washington, D.C.

By

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How to bridge the gap between the separate worlds of knowledge makers and policy makers is a problem at least as ancient as Plato, who sought to resolve it by integrating the two in a single individual: the philosopher-king. Yet even in the simpler and comparatively unchanging, hierarchical social order of the ancient Athenian city-state, Plato's proposed solution represented a "utopia" in the modern sense of something naively unworkable as well as in the sense of an ideal in which he used the term. In our complex advanced industrial society, the problems of providing for knowledge makers, in sufficient number and with the necessary expertise and other prerequisites, as well as for appropriate articulation between knowledge makers and policy makers, are much more serious than those Plato faced, and more consequential as well. Indeed the treatment a modern society accords its experts on the future, i.e. the extent to which it solicits and attends to their forecasts and takes care to differentiate and reward those seers whose forecasts prove reliable as opposed to those whom future developments show to be faulty, deeply affects the society's capacity to exercise control over its own fate via deliberate guidance of societal processes.

Unhappily our society's treatment of its seers by and large, takes the form of malignant - as opposed to benign - neglect, a frequent reliance on experts chosen for irrelevant reasons rather than because of their proven wisdom. The result is chronic myopia of much of policy-making, seeing the nearby trees, but not the turns of the road.

Sound future-orientation requires:

1. Futurology should be integrated rather than segregated from other forms of knowledge making.

The best exploration of the future draws heavily on understanding the existing societal processes and their dynamics. Thus in seeking to anticipate, for example, the extent to which Americans might be likely or willing to adjust to future energy shortages and price rises by shifting to less energy-intensive life-style, the responsible seer takes into account the conditions under which life-styles changed in the past, the extent to which previous life-styles adapted to new conditions, as well as changes which already occurred in the last two years, etc.

The trends discerned in these data are then interpreted in the light of some assumptions, such as, for example, an estimate of the likely persuasive power of a major public education campaign, in order to arrive at a projection concerning the potential willingness of the American public to become more energy conserving. In contrast, the segregated futurologist is more likely to rely on projections founded on logic rather than experience, "models" which are often mathematically neat but poor in reality-testing.

2. Deviation from data should be explicated.

Future-studies almost invariably require mixing into data distilled from past trends, hypothetical assumptions about what might happen in the future, drawing both on reasonable assumptions and on value preferences. Futurologists must be free to insert

these add-ons because they provide projections with their horizon-broadening power. However, whenever they deviate from existing data, they should (a)explicitly state this fact, and (b)explicate the grounds for the deviation from straight-line projections of the past into the future. It is not that straight-line projections (i.e. assuming the future will mirror the past) are sensible, but that unaccounted modifications open the door to wishful thinking. Accountable modifications are thus the responsible course.

Thus one may make a forecast based on the premise that the OPEC cartel will soon fall apart, despite the fact that many previous cartels, particularly in the oil field, survived for decades, but in doing so one ought to flag that one is deviating from expectations derived from past experience, and explicate one's reasons for believing past patterns are unlikely to be maintained.

3. Heuristic futures and forecasts are to be carefully separated.

Heuristic futures are intellectual games or exercises offering insights into what might happen if a given set of circumstances were to come about, without necessarily making any claim that there are highly persuasive, let alone compelling reasons for believing these circumstances will indeed come about. Heuristic futures serve to stimulate policy review and renovation in the sense that they tend to encourage those open to them to explore alternatives they would not have considered otherwise. Thus, a downtown area wholely closed to vehicular traffic might be contemplated,

or a Zero Population Growth United States, or lunar settlements, to see, for instance, if the benefits might justify the costs, without predicting that either of these is on its way.

Similarly, forecasts which are highly unspecific tend to be actually of primarily heuristic value. Thus, to say that the United States population by the year 2000 will either rise by 75 million or fall by 25 million, or be somewhere in between, provides an opportunity to contemplate alternative futures, rather than a forecast of sufficient specificity to be of interest for most purposes.

In contrast, forecasts ought to be relatively specific, i.e. provide narrow ranges. In most areas, very specific forecasts cannot be expected because the world is too complex and the dynamics of most of its parts are still poorly understood. (Lunar eclipses are one of the exceptions.) However, unless the range is relatively narrow, it will not help much in preparing for the future. Thus, it is more helpful to be told that there is good reason to forecast that no major new breakthrough of new sources of energy can be expected to be available on a mass basis up to 8 to 10 years from now, than to be told that a major breakthrough is basically unpredictable and could be with us in the "near future".

4. Guidance intensity and heuristic futures vs. forecasting.

While both heuristic futures and forecasts are useful, the extent to which we should promote one as against the other depends on our assumption as to how knowable and malleable the world is, i.e. subject to our guidance. To put it first in extreme terms for illustrative purposes, if we assume we can know the world

fully and mold it to our design, we can rely chiefly on heuristic futures because they tell us what it would be like if this or that "future" were to be brought about, in line with our preferences.

If on the other hand we believe the world to be relatively difficult to comprehend and to mold, we must rely more on forecasts as to what will happen. For reasons I detailed elsewhere,* I hold that while the world - especially the social realm from crime to alcoholism, from education to welfare - is becoming more knowable and malleable, it is still, by and large, largely unknown and above all very resistent to our efforts. Hence, we should rely more on forecasts and less on heuristic futures.

5. Near- vs. long-run future forecasting.

In some areas it is possible to forecast the relatively remote future (more than 10 years) and do so responsibly. Thus, for instance, the size of the 1986 fourth grade cohort can be quite well projected for the entire United States on the basis of the current birth rate, childhood mortality rates, and school attendance data. In many matters, however, experience suggests we cannot forecast with sufficient specificity to be useful beyond 5 to 10 years. It is not just that we can not correctly forecast the "readings" on the appropriate variables and, thus, they go down where we expected increases (e.g. in population) or up where we expected declines (e.g. prices), but major vectors often appear that were unanticipated (e.g. the energy crisis).

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* Amitai Etzioni, The Active Society: A Theory of Societal and Political Processes (Free Press, New York, 1968)

In any event, forecasters who wish policy makers to attend to what they have to say concerning the remote future, say the year 2000, might wish to use as a testing ground the next 3 to 6 years as a means of validating their forecasting techniques.

Indeed the short-term future is problematic enough to predict and such predictions often woefully wrong. In 1965 Thomas S. Power, Chief of the Strategic Air Command, wrote a book entitled Design for Survival in which he used the example of bombing North Vietnam as a hypothetical situation in which air strikes could deter a war. The aim would be to get the Communists out of South Vietnam, so the United States would warn the North of an air attack, giving the enemy time to evacuate civilians, and then bomb. This should be done until the enemy agreed to remove its influence from the South. It would only take a few days, Power wrote; no ground troops or air reinforcements would be needed. In fact, the Communists would welcome this as an opportunity to pull out of the South. In 1960 C.P. Snow said, on the likelihood of nuclear war, "Within ten years some of these bombs are going off. I am saying this as responsibly as I can. That is the certainty ... a certainty of disaster."

Each year thousands of such predictions are made in all areas from inflation rates to cancer death rates, from traffic fatalities to interest rates. In most areas no record is kept of the predictive powers. When such studies are undertaken, as for instance in predicting the stock market or the prices of specific stocks, the difficulties in making specific predictions stand out.

As the short run (one to three years) is more knowable than the intermediate run (three to ten years), let alone the year 2000 and beyond, we should concentrate relatively more on projects that promise near vs. longer-run outcomes. E.g. in the energy field, this suggests, an emphasis on coal and nuclear power vs. shale oil, with the greatest payoffs to be expected from efforts to conserve energy, which can be implemented almost immediately.

Moreover, the likelihood that unexpected vectors will intervene to throw off our forecasts suggests that we should be ready to recommit our resources and efforts as we move into the future and find, alas, that we have again erred (the Arabs will roll prices back? New unknown reserves will be found? A cheap way to milk the sun? An additive that stretches gas 40% or more?). We should not allow setups that lock us in, of the sort exemplified by the Highway Trust Fund which still pours billions into highway construction when clearly a higher priority as of now should go to public transit.

Similarly, we ought to favor those changes in housing and industry which can be readily made and then unmade if necessary (e.g. taxes on gas and oil, which can be reduced by a stroke of a pen) rather than those which are difficult to reverse (e.g. conversion of home heating systems from gas to electricity, as the Project Independence report suggests).

Finally, because of the difficulties in making valid, sufficiently detailed predictions, let us also focus on those efforts which are desirable in themselves, or for reasons other than their elusive futuristic pay-offs. Thus, driving at lower speeds saves thousands of lives. We should maintain and enforce the lower

speed limit even if we are not sure that otherwise there will be a shortage of gas in 1985 or that we'll run out of oil in the mid-1990's. Similarly, a commitment to developing solar energy vs. a heavier reliance on nuclear reactors seems a much sounder policy from the viewpoint of public safety and harmony with the environment, even if we cannot tell which will produce cheaper electricity 10 years hence.

6. Forecasting would benefit from systematic evaluation.

Reliability ratings for bonds (i.e. predictions concerning the likelihood these securities will pay future dividends and return their principals) are regularly issued in terms of AAA, AA and so on. Restaurant guides award the four or three or fewer stars according to the excellence of the cuisine and the likelihood future diners will be served comparable meals. Forecasts used by government agencies, the business community and the public, are rarely rated. As this field knows its share of shamans, it is surprising how often one sees the fakers at the head tables, while the true prophets roam the streets. Thus, a leading designer of the war in Vietnam, author of a report which caused universities to shift billions from the bond to the stock market just before the latter collapsed, and an advocate of a school decentralization plan which led to substantial anarchy, is still one of America's respected seers, while the editor of a major science magazine who correctly prophesized the energy crisis in great detail in 1971, is rarely invited to address the inner sanctum of policy making.

A computer retrieval system of forecasts and predictions made in the past combined with information on the events which followed, would help the forecasters to improve their work, and their clients to evaluate the advice they rely upon - or ignored. Too often we oscillate between blind faith and cynical contempt for futurologists. It might help to realize that like other professionals, their qualities vary, and the more reputable ones are inevitably better than no help at all but no one owns a clear crystal ball.

7. Policy makers' criteria for selection of forecasters.

Particular seers come to be favored by policy makers for many reasons: in some instances because they favor a position the policy maker has already chosen; in others, because the seers chosen are dramatic and will "bring out the press and television"; or simply because they are witty, charming or pleasant company. Naturally, our capacity to deal with the future improves the more seers are listened to on the basis of the proven validity of their forecasts and disregarding their partisan, or media, or "social" characteristics.

In Conclusion

All in all, it cannot be stressed enough that to the extent that policy makers draw on futurology, the nation's business will improve. The extent of the improvement depends on using more forecasting, less heuristic futures; more near-term, less long run, forecasts; and drawing more on proven forecasters than on those whose forecasts are reassuring, convenient or dramatic.

Dr. Amitai Etzioni is Professor of Sociology at Columbia University and Director of the Center for Policy Research, Inc. His main works are The Active Society (a Free Press paperback), Modern Organizations, Political Unification, and Genetic Fix (a Harper & Row paperback), which was nominated for the 1973 National Book Award in the area of Science. His most recent work is Social Problems (Prentice-Hall, 1976). Dr. Etzioni has consulted for government agencies as well as for a large number of local governments and municipalities. He has written widely for professional as well as other journals here and abroad including The Wall Street Journal, The New York Times, and The Washington Post. Among his research projects he has conducted studies for the Department of Labor, The National Science Foundation, The President's Commission on the Causes and Prevention of Violence. He completed a two-year term as a member of the editorial board of Science. Dr. Etzioni is married and has five sons.

Senator CULVER. I think that we are extremely fortunate this morning to have the benefit of these four outstanding contributions on this subject.

I would like to take this opportunity in this initial hearing to afford the opportunity for the witnesses to address a question or two to each other.

Perhaps we might throw it open for a few minutes to let each witness further develop, or challenge, or agree with the observations of one of the other panelists.

Would someone like to start? Ted Gordon.

Mr. GORDON. A question for Dr. Etzioni. The notion of professionalism in futures research is one that I think ought to be followed up. You introduced it well. It is a subject that has bothered us, of course. But every time we try to come to grips with the AAA system, we wonder who can apply the AAA stamp.

Inevitably, elitism gets narrower and narrower as we try to emulate accreditation systems of other disciplines. Do you have any thought about how that could be done?

Mr. ETZIONI. Let me first say I didn't discuss the significance of citizen participation largely because you two did such a fine job on it.

I very much agreed with the same point. Without citizens' participation, plans will not be accepted. So what is the use of having a plan which will be extremely professional if we don't have a consensus to implement it?

Therefore it is absolutely essential on all levels—local, State, national—to have the participatory effort.

As a first step to increase the professional content of the effort, I would think that the simple system would go a long way. If on Monday you want to consult expert Z and the computer prints out what expert Z has said over the last 10 years, this would help expert Z to somewhat moderate his or her statements simply because expert Z knows his record is available. That is a very primitve way of doing it.

So, for instance, over the last year the economists who have kept a record have become much more modest. The economists now say their ability to predict the future is not as good as they thought it was 5 or 10 years ago. Why? Because they saw the prediction about unemployment and interest rate deviate more than they thought was necessary.

That is the very first step.

The next step is to distinguish those who make serious forecasts from those who say like Morgan said, that the stock market can go either up or down or stay the same.

For instance, the Hudson Institute specializes in this kind of forecast. They deal often in heuristic futures. That is of significance. If you never thought things would go up or down or stay the same, and if somebody points out these alternatives, you are wiser.

But these kinds of predictions are going to be true automatically so they need to be separate from the others.

The more specific a prediction is, the higher a rating an expert would get—if it is correct. The vaguer the prediction, the less value should be attached to that effect. For instance, a census predicts that the population by 1980 will either go up by 50 million or go down about 50 million or be somewhere in between. It is a 100-million range. That is not sufficient specificity for most purposes.

Beyond that, once we introduce this consideration, the computer can do the rest by giving a reading of accuracy. So, faced away from elitism and away from "isms" to a program which establishes retrieval, that establishes a record. We have put forward a mathematical computation of a degree of error.

Mr. TOFFLER. I have been an admirer of Amitai for a long time. I find myself in substantial agreement, that it is almost cloying to say so today. Most of us tend to be agreeing. But I am a little leery of the idea of track records for futurists because of one of the problems that Ted raises here.

The question of the whole notion that you license people to talk about the future. That is carrying your point beyond the moment that you are raising certainly. But also in the notion that you judge forecasters by the past accuracy of the forecast, the idea of linear change.

It is implicit in there that if he or she was right in the past, he or she could be right in the future. That has very profound, philosophical, and other implications itself.

My own concern is the little bit, I mean we are not taking extreme positions here in the sense that there is an awesome amount of nonsense which is put forward in the name of futurism.

And there is an awesome amount of nonsense that puts forward in the normal daily practice of a political system or a social organization or whatever.

It is a question of emphasis. What I hear Amitai saying is that we need to be more empirical and we need to check forecasts against reality more often and be a little less concerned about the future out of the blue sky components, although recognizing the usefulness of those as well.

My own emphasis would be perhaps a little bit the other way because it seems to me that there is an absolutely overwhelming tendency on the part of large organizations to come to grips with the present and the immediate and to ignore the long term for reasons that have been alluded to, that there are constraints and rewards built into the Congress of the United States and to the political system of the United States that rewards short-term thinking and punishes long-term thinking.

The fact that terms of offices are limited to 2 years in the House, or 6 years in the Senate, or 4 years in the White House, have a great deal to do with the degree to which the future gets adequately considered and imposes a very short-range emphasis on our analysis of public issues.

In business, despite the fact there are many corporate planners and economists, there is also an enormous pressure for short-range results for this year's profit and loss statement rather than what the shape of the enterprise will be over 10 or 15 years and also for a very narrow range of concerns.

So that there are many economists in the business but, alas, they deal with just economics too often. They are just beginning to recognize there are other factors that need to be considered.

Because of these enormous inbuilt pressures on the conception of time in organizations, I would perhaps lean a little bit more toward the view that it is good to hear longer range scenarios, longer possible

futures discussed, even though they may not have immediately practical utility because they may, in the course of discussion, point to options that aren't immediately evident.

Dr. ETZIONI. May I pursue this for a moment? Again, I will not cover the ground we all agree upon. I think people have to be held accountable. We are horrified of the notion that a physician would go and give prescriptions to a patient and avoid the consequences.

You come to a patient and say take that medicine; it will cure you. Then you walk away not checking if the medicine cured him or killed him. If the physician made an error the first time, he should correct himself.

So now we come to the people who make decisions for society who, like physicians, say do this or do that because, otherwise, the Nation's future will be this or that. It would be equally irresponsible if you don't come and check what our interventions led to.

We have a situation where every policymaker of any stature has a large number of persons coming to him, each one saying if you just do this, the future is going to be like that.

The question is how to bridge the short run and the long run. The only way we can bridge them is by some kind of a check on new forecasts. If you want to wait for the year 2000 to check the credibility of forecasts, it is going to be too late.

Some of us are going to be retired or dead.

Most seriously, the year 2000 will be upon us and it will be too late to fix it. So we have to use the last year or the next year to know which one of a practically endless set of alternatives to choose from. All the descriptions of the longrun futures are mind-broadening, but only a few of them have a reality.

Then we come to the question of licensing. God forbid, everybody should be allowed into the future business. The only question is will they be held accountable.

One more sentence about straight-line forecasts. I don't think there is any reason to tie that to straight-line forecasting. Indeed, the good forecaster should not only be happy to be right, because if you make enough forecasts it is like shooting ducks in the dark, if you shoot enough you are going to hit the duck eventually, but the problem is of saying why you believe what is going to happen is going to happen.

You identify the factors. If you can do that, then you will be able to predict changes. Because what will change is depending on them.

Senator CULVER. Could I at this point solicit your comments on this general question of planning? This morning, at the risk of oversimplification, Dr. Etzioni has talked about accountability, and Mr. Toffler has placed particular emphasis on the need for a very pervasive participation in futures analysis and forecasting not only in Government but outside.

Mr. Gordon has even suggested the formation of an Office of Planning at the national level, and the desirability of a Presidential-congressional agreement on some plan, which essentially parallels pending legislation now in the Congress. This legislation at least is being used as a vehicle for debate on the subject of planning.

Dr. Madden has talked less about a confidence in the actual value of a formulated national plan, but more about an emphasis on the exercise of a planning process itself to illuminate vision, to discipline a process of thought, and to maintain flexibility.

You mentioned, Mr. Toffler, the constraints that our own political process imposes in terms of our electoral process—the short-term character of it. The Canadian Government, as you perhaps all are aware, 10 years ago tried to set up an Office of National Planning, and tried to formulate a national plan where they could get the acceptance of the Parliament. It didn't work. They didn't really support it, and it was essentially brought down by the political problems.

As Mr. Toffler mentioned, none of these other experiences in national planning has been that overwhelmingly impressive. We have the model of such societies as the Chinese, the Cubans, the Swedes, the Japanese, Great Britain, the French indicia planning, and so on, all of them trying to tailor and design a model compatible with their own political system, their economic and cultural traditions, and social attitudes.

Where does this really leave us? There is this general public perception that we cannot keep lurching from crisis to crisis. If you invoke the word "planning," it conjures up all these horrendous notions of an excessively overregimented society which is inflexible.

If you really talk about going through our own political process, it is hard to conceive, given the difficulties we have in getting an agreement on a tax reduction for next year, that we are really going to have a national plan that is anything but weak tea, that manages to survive the political process of the executive and legislative give-and-take only for openers, and that takes into consideration the taxicab driver in Salt Lake City and perhaps makes his vision of the future prevail.

Because of Mr. Gordon's computer, he was right twice the year before. I don't mean this is really what it is all about, but we might as well get to the heart of the matter.

We now have a vote pending, and I am going to have to cast my vote. I will be back in 5 minutes following the recess for that purpose. Then maybe you could give us your thoughts about the possibility of a national planning effort, and then we can perhaps wrap up the hearing this morning.

I will be back in 5 minutes.

[Brief recess.]

Senator CULVER. The hearing will come to order.

I very much appreciate your understanding and indulgence this afternoon. I hope we can get your comments on that question, and then perhaps we could have the other questions submitted for the record.

Dr. Madden, would you like to start.

Dr. MADDEN. May I respond with a couple of points?

Senator CULVER. Excuse me, Dr. Madden, I think Dr. Etzioni has to leave early. Could we get him first, if you don't mind.

Dr. MADDEN. Yes.

Dr. ETZIONI. I have to apologize to you and my colleagues for having to leave. Just very quickly, I would like to say that on this point I differ most from some of my colleagues, because I believe if by planning one means an encompassing comprehensive setting up of priorities in the future, and then organizing things, accordingly, I believe it would be easier for us to walk on water than to plan for the futures in that sense.

What we best can do is wisely inject the few indisposable, uncommitted points we have, resources or energy, to improve the balance of the picture in an area which is going to come to a head, in my judg-

ment, very much over the next few years and in which we will have a good opportunity to try our hand at that; limited planning is the management of credit. This is a much more indirect form of planning than telling a corporation what to produce or a city what to do by making available more housing and less for cars, and so on and so on.

At the moment, the United States is one of the few countries which does not aline its credit for social purposes but allows its credit to be alined by partisan considerations. It is a relatively more manageable sector.

It affects all other sectors. Therefore, if we all could hope to move toward something which could be considered a forerunner of planning, that would be my favorite area. I am sure there are other——

Senator CULVER. Could you give one quick example of that.

Mr. ETZIONI. Yes. I would order the Federal Reserve to order the banks that every time a person makes a loan for a car, he should pay 2 percent above the prime rate and thus making car acquisition less attractive.

He can get 2 percent less than the prime rate if he buys a house. Indeed, all major social purposes would be labeled as above or below the prime rate.

We could make the bonds for schools 3 percent below the market; for big new factories, 6 percent above the market, and so forth, in line with our social purposes.

That requires, as we have in West Germany, in France, and in Britain, much less autonomy for the banks a seminationalization of credit, and therefore allows the Nation to engage in a measure of planning. May I apologize again?

Senator CULVER. Dr. Madden.

Dr. MADDEN. Just briefly, to show you the range of opinions among futurists, I would disagree with that last proposal of allocating credit. As a matter of fact, the Senate has just passed a bill and the House is soon to pass it which, over the next 5 years, will repeal limitations on the ceiling interest rates set on housing and therefore we won't have boom and bust in housing credit once that ceiling is removed, because housing credit will be able to compete directly with credit for other sources.

But, more than that, my own experience as an employee of the central bank in the past has convinced me that it would be a mistake to allocate credit as a means of planning for the same reason it is a mistake to have, let's say, a universal-type central economic plan which gives power and authority to planners to make decisions which we traditionally have made in markets or by some other means, local or statewide, or Federal, via the institutions of democracy. I have written about that in my testimony and elsewhere.

But I would like just to register that point.

With respect to the question you asked, one of the points I think we haven't brought out here is that a process of considering longer range questions for a congressional committee, for a corporation, for a city, for an organization is really a process of education as to what is possible.

It isn't easy for us in any area of modern life to keep in mind what is possible or to be aware of what other people realize is possible.

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Technological forecasting, for example, is a more or less systemic way of reminding ourselves what may be technologically possible. Whether it would work or not depends for us in this society on testing this question through the marketplace.

And there are lots of technologies around never used in the marketplace because they haven't been economical. Even so, though, the recitation of a list is useful.

But more than that, it has been my experience in engaging in processes of planning personally in a group, one group or another, that engaging oneself in such a process for most of us whose imaginations are fairly undeveloped, leads to invention.

For instance, where did the idea of privatizing the production of public goods come from? I think it came from a forecast, an adverse forecast about the growth of government in the United States, and it led people to ask the question, What can we do about this? What possibly can we do about it?

Well, one can vote out those who wish to continue expanding the size of government. One can rail against it. One can examine the question and try to figure out what causes the growth of government, and then to invent something which might keep that from happening.

I was talking with Ted Gordon about Edison's famous experience early in the century of coming here to the Congress with a vote counting machine, an electrical vote counting machine, only to find out that Congress didn't want an electrical vote counting machine.

People wanted to delay their votes until they saw how their colleagues voted and they didn't want their votes counted in advance, so they would lose some advantage. This was a great lesson to Edison, according to his biography.

He went home and realized later that one had to study a system, one had to figure out what it was people wanted before he went around inventing things.

Senator CULVER. I want to point out that the House of Representatives put in electronic voting in order to reduce the time of half an hour for an average rollcall to 15 minutes. Now they find they are voting three times as much because it is easier.

There has been a net loss of time as a result of that innovation.

Dr. MADDEN. Right. I suppose Edison and his contemporaries may have been wiser then.

In any event, my point is that the process of involving oneself in the planning routines do draw attention to gaps, to possibilities for invention which I believe would not occur otherwise.

In an organization such as the Chamber of Commerce of the United States, made up of decisionmakers in business, there is a tendency for people to come to the chamber and serve on voluntary committees and vote as their consciences and their interests at the time suggest that they should vote.

One of the big functions of the staff is to provide a framework within which such voting can occur that provides other possibilities to the people who do the voting.

Senator CULVER. You are saying you would not support a national plan and feel it is not a politically or desirable objective?

Dr. MADDEN. I certainly would not support a national plan.

Senator CULVER. But you see adopting it in all these areas of government?

Dr. MADDEN. Right.

Mr. TOFFLER. Senator, I think two things. One is just a parenthetical comment about tracking forecasting records, Dr. Madden's reference to Edison reminds me that past performance of that kind is not a good basis for judgment. It was Edison, among others, who said that Orville Wright would never succeed. Edison predicted that airplanes would never fly. Yet his track record in the past had been pretty good.

On planning, which is the more central question, I think everybody at this table has some uneasiness about, and, indeed, some of us even have sharp objection to, the idea of a master plan. Master planning, as I said in my testimony a bit earlier, could be farcical or dangerous.

You cannot, I believe, plan for social change on the scale facing the United States today in terms of some master plan drawn up by a group of geniuses or a think tank in Washington, without either that plan being ignored or coercively applied with enormous danger to the system.

That, however, is not the alternative. We should not permit ourselves to be trapped between the idea of either a master plan with targets for industry after industry—and then a later stage, perhaps, coercive measures to enforce the application of those targets—to be trapped between that, on the one side, and the kind of blind, stupid bungling and stumbling into the future that we are doing now.

There are many, many options in between. I think, without trying to repeat what I said in my earlier testimony, we should be encouraging experimentation. We should be looking for those options.

We are very good at technological invention. We are less good at social and political invention. We are faced by the need now to engage in social and political invention.

One of the things we most desperately need to invent is a participatory planning system. Maybe the word "planning" itself is obsolete, although we don't have a better word for it.

I sometimes say what we need is "anticipatory democracy" or we need "superindustrial futurism." We need to take a look at these many experiments now already going on around the country and to provide some support for these in the way of funds, in the way of evaluation.

In addition, we have, in many pieces of existing legislation, requirements for citizen participation, requirements for planning. I would urge the Senate to request the Congressional Research Service or somebody else to pull together all of those statutory planning requirements and take a look at them: see which ones have, in fact, been applied, and which ones have not, and which ones have worked, and which ones have not. We need to see these participation requirements that we have passed over the past 10 years as first experimental steps toward the invention of a participatory planning system that could help us out of our present mess.

We may very well have tools at our command that we never adequately used.

To simply summarize what I am saying, let us not get trapped between the master planners on the one hand, and the antiplanners on the other hand. Let us look with fresh eyes at the tools that we have

available to us and invent new tools and support the search for a new process.

Senator CULVER. I think the other aspect of that is not only vertical development of increased institutional capacity to look ahead and anticipate options but also the horizontal development of networks. I think we have today in our Government, on a very spasmodic and ad hoc basis, some very useful and commendable bureaucratic work being done in our major departments, but the real problem is to see that that information is shared by relevant decisionmakers, that it is collated, that it is analyzed and put in the hands of the right people in a timely fashion so they can make enlightened judgments.

Mr. TOFFLER. May I say one last paragraph.

I have before me the Monday, December 15, 1975, issue of the New York Times. The lead story says, "Soviet Discloses New 5-Year Plan With Lower Goal."

Of course that is not news. If we look at the Soviet planning system or if we look at other governmental planning systems, we have to be struck by certain underlying characteristics that are true of all of them. They differ radically. They are very different in Japan and in the Soviet Union, for example. One is capitalist and one is Communist.

If we look in France, if we look in Sweden, if we look in other industrial countries, we see many, many different planning systems. But they all share certain fundamental characteristics.

And that is what we should be aware of and that is perhaps what we ought to be worried about.

They all are heavily focused on economics. They are all basically national rather than decentralized. They are all short range, thinking in terms of 5-year plans, rather than longer periods of time. And they are all top down.

If we can use that as a checklist of things to avoid, we have the basis, perhaps, for designing alternatives and then plugging those more decentralized participative planning systems into some sort of integrated network-based information system at the national level.

Senator CULVER. Mr. Gordon.

Mr. GORDON. Senator Culver, I disagree with Dr. Etzioni in his statement about credit and would like to use that as an example of why I think national planning, which I will define more precisely in just a moment, is necessary.

He suggested adding a 2-percent surtax to credit borrowed for the purpose of buying automobiles. That may well change the patterns of buying automobiles. I don't dispute that at all, but it may also create a set of other circumstances which are not yet completely thought through.

For example, what would it do to the rest of the socioeconomic system? What would it do to mobility? In fact, would people find it desirable?

The idea of pretesting of proposed legislation to identify consequences, I think, is an important feature of any planning system. Dr. Etzioni's idea is certainly imaginative, but one which would have to be tested fully, I would think, before it became a matter of policy.

It is an example of incrementalism. It is an example of a set of implicit goals for which we think we have a fix, but we are not sure if people share those goals.

A planning system which builds from the bottom up, such as the one Mr. Toffler has suggested, has some problems with it. For example, it is not adequate, I think, to simply vote on desirable images for the future for the country.

I would be afraid in that kind of system that we would subdue minority positions, that we would not give adequate weight to those futures which do not incorporate and reflect a sensitivity to minority positions. Somehow in a democracy those minority positions have to be given extra weight and extra sensitivity.

It is inadequate to say that we will vote on the future and that such a vote could become the basis for planning.

Mr. TOFFLER. I couldn't agree with you more, Ted. What is implied is a questioning of 51 percent, that is all. That is a majoritarian idea that grew out of industrial mass society that now I think is going to have to be reconsidered.

That is a very profound political question facing us, but to say we involve people in helping us set the goals of the system does not necessarily mean that.

Mr. GORDON. No. And I agree with his statement, of course. There are significant problems in involving people in setting goals for the system. I will address that in just a second.

Imagine that the goals have been set. Then I would think that a Federal national planning system ought to be one in which those goals and their ranges are made explicit, and agency plans, budgetary plans, plans in general, created by the bureaucracy are checked against that set of goals. They become a set of guidelines. They become top-down implementation of what has come from the bottom up.

That, I think, should be the essence of a planning system.

Mr. TOFFLER. Senator, would it make sense to describe how that precisely was done in the State of Washington? Do you want that on the record?

Senator CULVER. The index, the legislation and its compatibility with the goals.

Mr. TOFFLER. Yes.

Senator CULVER. Why don't we submit that for the record at this point.

Without objection, that will be ordered.

[Mr. Toffler supplied the following:]

Furnished by:
Alvin Toffler

DESCRIPTION OF THE WASHINGTON STATE PROGRAM TO BE INSERTED ON PAGE 94 IN THE TRANSCRIPT OF THE PUBLIC WORKS COMMITTEE HEARINGS, DECEMBER 15, 1975.

In Washington State, if my information is correct, the state planning office took as its slogan "You don't have to be an expert to know what you want." It accepted the idea that it could not plan adequately for the state without involving the citizens of the state in the planning process. It then went through the following procedures.

1. It went to the various citizens organizations in the state -- unions, women's organizations, churches, business groups, professional associations and the like -- and asked them to submit names of their members who, in the opinion of the organization, ought to be thinking about the future for them.

2. Having collected between 4000 and 6000 names, it used a random sampling of the list to select 10 regional commissions on the future for various parts of the state, and an eleventh panel to serve as a statewide commission on the future.

3. Members of these panels were given a variety of readings to get them thinking long range -- I believe they read Future Shock, H.G. Wells, and other future-oriented materials.

4. They were brought together for meetings and asked to suggest goals for the future of the state of Washington 15-years hence -- for 1989 when the State has its sesquicentennial.

5. When many suggested goals had been brought forth -- goals for transport, health, education, jobs, ecology and the like, the commissions began to study the interrelationships of these various suggested goals. They did, in effect, a cross-impact analysis.

6. When it was suggested that goals without strategies for achieving them were useless, the commissions began to write 15 year scenarios showing how these goals might be achieved -- what steps would need to be taken.

7. The commissions were asked what I regard as an especially crucial question: What if all these goals were actually achieved -- what new problems would they create. (That is a question that seldom gets asked.)

8. At this point it was clear that there were too many conflicting goals. Instead of pressing for consensus on a single program, or trying to get a 51 per cent majority behind one program, the participants were asked to shape up their goals into a variety of coherent alternatives for the state. Each alternative consisted of a general goal and a series of related goals or steps by which it might be achieved. Thus, one group favored rapid industrialization of the state and put forward a whole program of sub-goals designed to help achieve that. A second group sharply disagreed and put forward a program for the agricultural development of the state instead. A third group favored development of the state's recreational-tourist potentials. A fourth group urged that Washington become the main port of entry for American trade with China and Japan. Each such alternative was presented with a set of associated program goals dealing with health, ecology, transportation and the other elements that, together, determine the economy and quality of life in the state. Thus each alternative was more than simply a statement of a goal; it took the form of a coherent set or grouping of goals that,taken together, added up to a program. In total, eleven different alternatives for Washington were sketched out.

9. These alternatives were presented to all the citizens of the whole state. Over a million copies of a tabloid newspaper were tucked into the pages of the state's regular newspapers and distributed throughout the state. These tabloids presented the 11 Alternatives for Washington along with a ballot form that would permit readers to vote on the proposals and to mail their votes in to the state planning agency. The Alternatives were also presented on television throughout the state.

In some cases, I believe, two-way interactive programs were used that permitted viewers to telephone in their votes as between the various options.

10. To reach the many people who, because they are timid or seemingly indifferent, or uneducated, or otherwise hard to reach through these methods, the state planning agency conducted random sample surveys both by mail and by telephone throughout the state, asking citizens how they reacted to the Alternatives.

11. From these various procedures, the planning agency was able to infer or elicit a set of goals, as chosen not by the planners, but by a very broad cross-section of the citizens of the state in a procedure open to everyone, not just the experts, technicians, elites or vested interests.

12. From this procedure it became possible to construct a "legislative grid" or matrix by which the state legislature could measure its own performance in terms of the goals chosen by the citizens. Thus across the top were listed all the programmatic goals. And down the side were entered every one of the bills introduced into the state legislature -- some 700, I believe, as of the last time I had discussed it with someone in the state planning agency. Each bill was then systematically mapped against the goals, it provisions ticked off against the program goals to see whether it advanced or obstructed the achievement of those goals. I know of no such procedure in any other legislative body in the world.

This is my understanding of the Alternatives for Washington program. More detailed and correct information can, of course, be collected from state officials and from Mr. John Osman of the Brookings Institution who helped design the procedure. I present this not because I believe

this is a "miracle cure" for our planning problems. As a social critic and one interested in planning and futurism I can see weaknesses in the procedure, chiefly in what appears to be a failure to relate events and goals inside the state to those in the nation and the world as a whole. No state is free and independent, of course.

Nevertheless, I regard the Washington process as an extremely important experiment -- an experiment in the development of new-style planning procedures that involve the citizens, that make planning participative, that draw on the ideas, information, values and dreams of very large numbers of people. The Washington process is just one of many hundreds of experiments now going on around the country and the world in developing precisely the kind of bottom-up involvement that has been lacking in planning until now. In Iowa, in Hawaii, and in scores or even hundreds of cities, as well as in Sweden, Britain and other nations, an exciting search is under way for ways to democratize planning, ways to achieve what I call anticipatory democracy.

I strongly urge the Congress, before it polarizes around the old opposites of elite planning versus no planning, to encourage anticipatory democracy experiments around the nation. I believe that we can invent new planning procedures that will get us out of the trap in which we now find ourselves.

Mr. GORDON. A final point. There is a class of problems I believe that are so complex that the analysis required does not permit putting potential solutions to public test.

As an example, the world food problem, which is one of tremendous importance to the United States and to many people of the world. To say that planning to meet this problem should begin at the grassroots is, I think, the wrong way to go.

The alternatives open to us must be designed through a series of analytic studies.

Those analytic studies could then present information to the public.

Mr. TOFFLER. If I may, I think that that is too simple, Ted.

The world food situation, which is now building up, points toward a condition in which all parts of the world become wheat and grain importers except for North America.

That then raises the question of the use of American food as a weapon of foreign policy exactly the way OPEC uses oil.

Should the question of how America ought to make use of its food exports be one to be determined primarily through the usual expert foreign policy machinery? Or should that be a larger decision that the country in some sense participates in shaping?

Mr. GORDON. Here we are to the nub. Certainly it ought to be one in which the country participates. But in order for the country to understand the consequences of its advice, analytic framework must be available.

Mr. TOFFLER. What we are agreeing on here, I think, is that neither, at least, maybe we are not agreeing—let me state my own view, that ordinary people cannot make intelligent decisions about many complicated issues without the help of analytic intelligence and expertise.

But I would not personally like a system in which those policy decisions are then made by those who supply the expertise.

Mr. GORDON. I think we are agreeing at this point that that expertise is required and should not be thrown out in the interests of the grassroots input.

Mr. TOFFLER. It is not either/or. I believe a lot of our problems, philosophical aside, policymaking derives from Western philosophical tradition that can be traced back to Aristotle of thinking in terms of dualities of dichotomy. We tend to think in either/or. That is essentially an antifuturist mode of examining problems. Futurists tend to look for what is possible in the slash mark between the either and the or.

Mr. GORDON. You asked specifically what mechanism might be invented to gather public opinion into the planning process. I have some ideas here.

First, the congressional oversight function of the planning apparatus, whatever that is, could introduce hearings in which the specific focus would be alternative futures. What is it that the United States wants to become?

Senator CULVER. You are talking about a foresight function within each of the standing committees.

Mr. GORDON. Yes, sir.

Second, there have been a number of suggestions for citizens' assemblies of one sort or another, drawing from various interest groups.

Senator CULVER. Excuse me. How useful would that be at a time of archaic committee jurisdictions?

Mr. GORDON. Can I refuse to answer it? There is a serious problem here, of course, because problems in planning don't respect the committee's disciplinary divisions.

Senator CULVER. That could very possibly provide some of the political pressure for that kind of internal change too.

Dr. MADDEN. There is another possibility. I don't know whether it has any probability. I don't know whether it is practical, but we have a way to classify material other than as it is now classified by congressional committees, by standing congressional committees in their definition.

Would it not be possible to form other groups in the Congress which had no legislative authority but which were defined differently, such as the Joint Economic Committee has been defined, which groups would examine these questions on behalf of the Congress and make the examinations available to the members without authority to pass legislation that is implied.

This is what we have done at the chamber in respect of a group called the council on trends and perspectives. We have the right to examine questions that are broader than the jurisdiction of a particular standing committee in the chamber. But we lack the power to impose our conclusions on these committees.

They have the right to reexamine them.

However, at least we offered them a framework, an expert analytical framework which they otherwise would not get.

Senator CULVER. To some extent, hopefully, this will be a fulfillment of the Budget Committee potential. If it is properly done with the 5-year requirement, it will be in a unique position to engage itself at least in some of these alternatives.

Dr. MADDEN. I agree with you, except that some of us are concerned, Senator, that the intellectual setting within which that was drawn up—and the chamber of commerce in the United States was a leader in getting that legislation passed—suffers from a short-range viewpoint which has been described as neo-Keynesian analysis.

It is dominated by computer econometric analysis of questions.

If there were some thought given to other approaches that even were competing with that——

Senator CULVER. You are thinking, for the sake of argument, of a separate committee on trends and perspectives.

Dr. MADDEN. Not necessarily that title, but possibly some way of getting at the material that is not already set by the intellectual framework of the Budget Committee.

Senator CULVER. The argument against that, of course, is that we should institutionalize under each committee and if they say somebody over there is worrying about that, we can keep on our pedestrian ways.

That isn't exactly the best result. We will let Mr. Gordon finish his point.

Mr. GORDON. Three other ideas that occurred to me. The possibility of a citizens' assembly, if you will, involving interest groups, diverse interest groups, facing the question of what desirable futures do they see for the country. The alternative futures might be introduced into

elections, with candidates saying here is what I stand for in terms of the future image for the country.

Finally, the networks that we talked about before might be tapped to boil up these image sets.

Senator CULVER. I want to thank all of our panelists very much. I might make additional painful mention of the electronic voting machine in the House.

Apparently we now are playing games with the cards in the computer, to add suspense and uncertainty as to the outcome of the final voting. Under the original provisions, you could change your vote by inserting your card and changing the vote any time until the termination of the 15-minute voting period.

This would throw off the leadership. You could have a no vote or a yes vote and change it, and the whip system was thereby frustrated, absolutely confused.

Now, they have locked the system so you cannot change your vote. If you wish to change your vote after time has expired, you are required to physically go down to the well, present yourself to the Speaker, ask permission to change your vote, and we are back to a half-hour voting.

We really have the worst of both worlds. We have got the computers and we haven't saved time.

Thank you very much.

The committee will stand in recess upon the call of the Chair.

[Whereupon at 2:03 p.m., the panel recessed, to reconvene subject to the call of the Chair.]

[The following are Dr. Etzioni's responses to additional questions from Senator Culver:]

February 3, 1976

The Honorable John C. Culver
United States Senate
Committee on Public Works
Washington, D.C. 20510

Dear John:

In reference to the list of questions:

1. In your opinion, what particular kinds of models and forecasting techniques have been proven to be reliable?

1. I sincerely believe that no one knows the answer to this question; I certainly don't. As far as I know the various methods have not been adequately evaluated.

2. Would you please describe your concept of mixed-scanning and explain how it fits into the forecasting scheme?

2. Please see the enclosed (The Active Society), chapters 12 and (especially) 13.

CHAPTER 12

Mixed-Scanning: An Active Approach to Decision-Making

WE NOW explore a third approach to decision-making—one we consider more activating than either of the two strategies discussed above although it draws on elements of both of them. The first part of the chapter introduces this third approach and explores its foundations; the second part deals with the effects of other guidance factors on societal decision-making, especially on the kind of decision-making needed for active societies.

The Mixed-Scanning Strategy

Neither Rationalism nor Incrementalism

What is needed for active decision-making is a strategy that is less exacting than the rationalistic one but not as constricting in its perspective as the incremental approach, not as utopian as rationalism but not as conservative

as incrementalism, not so unrealistic a model that it cannot be followed but not one that legitimates myopic, self-oriented, non-innovative decision-making. The strategy of mixed-scanning, which we outline in the following pages, assumes that the criticisms of the rationalistic model are valid. While casters of well-balanced dice or tic-tac-toe players may be able to use a rationalistic model, an individual buying an everyday item in a local grocery store cannot, nor can a voter, not to mention an actor who makes decisions with macroscopic consequences.[1]* Referring to a rationalistic model, Charles Hitch states,

> The sort of simple explicit model which operation researchers are so proficient in using can certainly reflect most of the significant factors influencing traffic control on the George Washington Bridge, but the proportion of the relevant reality which we can represent by any such [rationalistic—AE] model or models in studying, say, a major foreign-policy decision, appears to be almost trivial.[2]

Rationalistic models do not provide an effective descriptive, normative, or analytic model for the conduct of macro-actors. Incrementalism, we suggest, is descriptive of a sub-set of decisions but not of the more effective decisions. In fact, if an empirical study were conducted, we would expect it to show that actors in a large variety of fields, when confronted with the impossibility of following a rationalistic model, use not an incrementalist but a mixed-scanning strategy. And more effective actors rely more on such a strategy than those who are less effective, as judged by the actual goals of the decision-makers.

Mixed-Scanning Defined

Actors whose decision-making is based on a mixed-scanning strategy differentiate contextuating (or fundamental) decisions from bit (or item) decisions. Contextuating decisions are made through an exploration of the main alternatives seen by the actor in view of his conception of his goals, but—unlike what comprehensive rationality would indicate—details and specifications are omitted so that overviews are feasible. Bit-decisions are made "incrementally" but within the contexts set by fundamental decisions (and *re*views). Thus, each of the two elements in the mixed-scanning strategy helps to neutralize the peculiar shortcoming of the other: Bit-incrementalism overcomes the unrealistic aspects of comprehensive rationalism (by limiting it to contexuating decisions), and contextuating rationalism helps to right the conservative bias of incrementalism. Together, they make for a third approach which is more realistic *and* more transforming than each of its elements. We shall first examine the strategy in general and then its structural foundations. Initially, we illustrate the strategy by discussing situations which

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* Reference notes for this chapter appear on page 305.

are limited in their societal importance but which allow us to outline the basic features of the strategy. We return shortly to macro-sociology.*

Mixed-Scanning Illustrated

Infantrymen taking positions in a new field in hostile territory scan it for hidden enemy troops. They are trained to scan a field. A rationalistic strategy is likely to be avoided because it would entail examining the whole field bit-by-bit, exhaustively, which would be dangerous and fatiguing and is likely not to be completed. Incrementalists would examine places in which enemy troops have been known to hide and some others near them or similar to them. Unlike the whole field, these places can be prodded by fire. Soldiers who are tired of marching and combat will sometimes follow this procedure. But armies known for their effectiveness train their soldiers in a different procedure. A major consideration in this regard is that accuracy of aim declines with distance. The infantrymen are taught first to scan the whole field in a rough, non-discriminating way for some obvious sign of danger (a movement, an unnatural shadow, and so on). If none is visible, they proceed with a bit-by-bit examination from the left to the right, beginning with the sub-fields closest to them and moving outward to more distant ones. The assumption is that scanning is going to become more superficial the longer it is carried out, which is made to coincide with the scanning of the more remote, less dangerous sub-fields.[3]

To take quite a different example, we find that weather satellites hold two cameras, one which takes broad-angle pictures covering large segments of the sky at one time in little detail and one which takes pictures of much smaller segments of the sky in much greater detail. Rather than covering all the sky in detail, bit-by-bit, thereby flooding the analyst with information that is likely to exhaust and frustrate him or make him non-discriminating, the dual scanning device is used first to take undetailed but encompassing pictures of the sky and then to scan for signs of trouble (e.g., cloud formations which might indicate a hurricane) which the second camera explores in detail.[4] It is more effective than merely examining the "familiar" hurricane cloud areas and a few others next to them, because even a rough scanning of the whole sky might show some obvious danger signs in other, unexpected areas. The same seems to hold for cameras on intelligence flights such as those of the U-2 and its latter-day versions and for reconnaissance satellites.

The relative investments active decision-making requires in the two kinds of scanning as well as in scanning in general depend on the cost of

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* In terms of the languages of societal analysis, incrementalism is atomistic and rationalism is voluntaristic (with instrumental rationalism solely voluntaristic and comprehensive rationalism containing collectivistic elements); no decision-making capacity is assumed in "pure" collectivistic language.

missing one hurricane, enemy, and so forth, and on the cost of additional scanning and the amount of time it takes. For instance, the scanning of Cuba was sharply increased after too little reconnaissance left the United States unaware of the positioning of Soviet missiles until they were almost fully erected.[5] Still, complete scanning was not possible.

Chess players are of interest for the study of decision-making strategy because the possibilities of combinations are much greater than those of infantrymen or cameras, and there is a clear measure of effectiveness in terms of the players' goals. A chess player cannot study all strategies at each move. Better players, we suggest, quickly review several strategies and then explore a sub-set of them in greater detail and an even smaller sub-set in still more detail. They reject all strategies of the first sub-set but one on the basis of some obvious disadvantages which make them undeserving of detailed examination. Were they able to examine all strategies in detail, they might discover that an alternative that had been rejected in this first round would have been the optimal one. But they cannot optimize. Still, we expect them to do better with this sequential combination of different kinds of scanning, going from vague but encompassing to detailed but exclusive examination, than players who only "increment" on the strategy with which they began or which have used successfully in the past.

Once the better player chooses a strategy, he will increment but only for a while. Sporadically, he will return to "higher" (or strategic) level of scanning, either because he sees outright signs of danger several moves ahead or because he wishes to explore whether or not the ever-changing situation allows for a still better strategy. The player who "increments" until trouble is only one or two moves ahead and engages in no strategic scanning even if there are no obvious dangers will, we expect, not do as well. Also, the better player attempts initially to establish a position in which several strategies can readily be adopted and often does not attempt to implement any one strategy immediately, because he is aware that such a procedure would reduce his capacity for *strategic* choices before the situation is relatively "developed"—i.e., specific.[6]

There is no reason that scanning has to be limited to two levels, one high in coverage and low in detail and the other high in detail and low in coverage; there can be more levels with varying degrees of detail and coverage, though it seems most effective to include one all-encompassing level (so that no major option will be left uncovered) and one level which is highly detailed (so that the option chosen can be explored as fully as feasible).

The decision to allocate the investments of assets and time among the levels is part of the strategy. The actual amount of assets and time spent depends on the total amount available and on testing various inter-level combinations. The amount spent also changes over time. At set intervals (or sporadically), an increase in the investment in encompassing (high-coverage) scanning is needed to survey the field for far-removed but "obvious" dangers,

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to re-ascertain fundamental assumptions, and to search for better lines of approach.* An increase in such investment is also effective when the environment radically changes or when the earlier increments lead to a crisis.[7]

Scanning (and, for that matter, almost all decision-making) combines the collection, processing, and evaluation of information with the process of making choices. As the actor "scans," he "takes in" information *and* explores alternative steps. Moreover, what information to collect, the extent to which to process it, etc. are also choices that need to be made in the decision-making process. While for some analytic purpose, knowledge-scanning and the making of choices are to be kept separate, in the following discussion—unless otherwise indicated—we explore them jointly.

Mixed-Scanning Specified

We now present the mixed-scanning strategy as an imaginary set of instructions written for an unimaginative decision-maker.[8] For heuristic purposes, we assume that at one point in time, the actor has no firm strategic commitments and faces a crisis that suggests that earlier policy lines ought to be reviewed fundamentally. United States foreign policy in the years after 1945, in which the containment strategy and the Truman doctrine emerged, would be a good example.[9]

Put into a program-like language, the strategy roughly reads:

a. *On strategic occasions* (for definition see d below) (i) list all relevant alternatives that come to mind, that the staff raises, and that advisers advocate (including alternatives not usually considered feasible).†

(ii) Examine briefly the alternatives under (i) (for definition of "briefly" see d below), and reject those that reveal a "crippling objection." These include: (a) utilitarian objections to alternatives which require means that are not available, (b) normative objections to alternatives which violate the basic values of the decision-makers,‡ and (c) political objections to alternatives

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* More encompassing scanning may be undertaken either at set intervals (e.g., annual review occasions) or when there is a special reason to do so (e.g., a new difficulty is encountered). The first method is more "demanding" but also more activating. However, both assume a capacity for non-incremental reviews.

† This is a redundant rule because all "relevant alternatives" include ones which may not be feasible. It is not needed for a computer but for human decision-makers. Its purpose is to counteract somewhat the tendency to form and maintain communities-of-assumptions. Such an "instruction" in itself will, of course, not suffice, and a structural arrangement is needed to provide power in support of inclusiveness. This is discussed on pp. 182–190 above.

‡ The instruction reads "basic values" because we assume that a decision-maker has some normative integrity which should be encouraged, but that most decision-makers will deviate from a secondary value if other considerations support a strategy they favor, and the model will not dissuade them.

hich violate the basic values or interests of other actors whose support ems essential for making the decision and/or implementing it.

(iii) For all alternatives not rejected under (ii), repeat (ii) in greater though not in full detail (for definition of scale see d).

(iv) For those alternatives remaining after (iii), repeat (ii) in still fuller detail (see d). Continue until only one alternative is left, or randomize the choice among those remaining (and ask the staff in the future to collect enough information to differentiate among all the alternatives to be reviewed).

b. *Before implementation** (i) when possible, fragment the implementation into several sequential steps (an administrative rule).

(ii) When possible, divide the commitment to implement into several serial steps (a political rule).

(iii) When possible, divide the commitment of assets into several serial steps and maintain a strategic reserve (a utilitarian rule).

(iv) Arrange implementation in such a way that, if possible, costly and less reversible decisions will appear later in the process than those which are more reversible and less costly.

(v) Provide a time schedule for the additional collection and processing of information so that information will become available at the key turning points of the subsequent decisions, but assume "unanticipated" delays in the availability of these inputs.† Return to more encompassing scanning when uch information becomes available and before such turning points.

c. *Review while implementing*. (i) Scan on a semi-encompassing level after e first sub-set of increments is implemented. If they "work," continue to an on a semi-encompassing level after longer intervals and in full, over-all view, still less frequently.

(ii) Scan more encompassingly whenever a series of increments, although ch one seems a step in the right direction, results in deeper difficulties.

(iii) Be sure to scan at set intervals in full, over-all review even if everying seems all right, because: (a) a major danger that was not visible during rlier scanning but becomes observable now that it is closer might loom a ew steps (or increments) ahead; (b) a better strategy might now be possible although it was ruled out in earlier rounds (see if one or more of the crippling objections was removed, but also look for new alternatives not previously examined); and (c) the goal may have been realized and, therefore, need no further incrementation. If this occurs, ask for new goal(s), and consider erminating the project.

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* These rules are necessary, non-incremental preparations if later "incrementing" is to possible.

† Rules (i) to (v) have been widely used in planning projects in which research and elopment play an important role. Reversibility declines (i.e., turning points are passed) ith the transition (a) from research to the full-scale development of prototypes and (b) om prototypes to line production. (c) There are more such points, the more development s lateral rather than longitudinal. On the other hand, lateral development saves time.

d. *Formulate a rule for the allocation of assets and time among the various levels of scanning.* The rule is to assign "slices" of the available pie to (i) "normal" routines (when incrementing "works");* (ii) semi-encompassing reviews; (iii) over-all reviews; (iv) initial reviews when a whole new problem or strategy is considered; (v) a time "trigger," at set intervals, to initiate more encompassing reviews without waiting for a crisis to develop; and (vi) an occasional review of the allocation rule in the over-all review, and the establishment of the patterns of allocation in the initial strategic review.

Writing out all these instructions might make mixed-scanning seem unwieldy and complicated; actually, its main features are simple. It combines various levels of scanning, some more encompassing but less detailed and others less encompassing but more detailed. It also provides a set of criteria for situations in which a particular level of scanning is to be emphasized, with encompassing scanning (both lateral and longitudinal) appearing not only in a crisis situation but also at set intervals even when incrementing seems to lead toward the solution of the problem at hand. The annual Congressional debate over the budget, the President's State of the Union message, and meetings of the Council of Economic Advisers have some elements of such a strategy in United States' decision-making.

The Relations Between Fundamental and Incremental Decisions

The incrementalists do not deny the existence of fundamental decisions such as a declaration of war; they argue, however, that incremental decisions are much more common.[10] While incremental decisions do greatly outnumber fundamental ones, we suggest that the latter's significance for societal guidance is not commensurate with their number, and that it is a mistake to relegate non-incremental decisions to the category of exceptions. It is the fundamental decisions which set the contexts for the numerous, bit decisions. This observation can be elevated to the level of a proposition: We expect most fundamental decisions to be followed by incremental ones that tend toward the same general direction. Also, fundamental decisions are often "prepared for" by bit decisions. While this makes the fundamental ones—when finally made—less "fundamental," the fact that decisions—such as the declaration of war—are somewhat less drastic shifts in policy than is often maintained does not mean that they are not basically fundamental. The bit decisions which follow them cannot be understood without them, and the preceding bit decisions are often wasted unless they lead to fundamental decisions.

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* If no objective measure is available, this is to be determined subjectively by the decision-makers.

Whether or not a series of incremental decisions is, by itself, less effective than a fundamental decision is an open question,* but the question is much less important than it appears if we take into account the relationship between fundamental and incremental decisions. The incrementalists say that the actor chooses between these two kinds of decision-making. We suggest that (a) *most incremental decisions specify or anticipate fundamental decisions, and* (*b*) *the cumulative value of the incremental decisions is greatly affected by the underlying fundamental decisions.*

Thus, it is not enough to show, as Richard Fenno did, that Congress makes primarily marginal changes in the federal budget (a comparison of one year's budget for a federal agency with that of the preceding year showed, on many occasions, only a 10 per cent or lower difference),[11] or that the defense budget does not change very much in terms of its percentage of the federal budget, or that the federal budget remains the same in terms of its percentage of the Gross National Product.[12] These bit changes are often indicative of trends which were initiated at critical turning points at which fundamental, contextuating decisions were made. The United States defense budget increased at the beginning of the Korean War in 1950 from 5.0 per cent of the GNP to 10.3 per cent in 1951. The fact that it stayed at about this level (between 9.0 and 11.3 per cent of the GNP) after the war (1954–1960) did reflect incremental decisions, but these were made within the contextual decision of engaging in the Korean War.[13] Fenno's own figures show almost as many changes of above 20 per cent as below this level (211 out of 444 budget changes, within one year, were 20 per cent or larger). Seven budget changes represented an increase of 100 per cent or more, and 24 budgets increased 50 per cent or more.[14] Once Congress set up a national space agency in 1958 and consented to support President Kennedy's space goals, it made "incremental," additional commitments for several years. But, first, a fundamental decision had been made. Actually, Congress, in 1958, drawing on previous experience and on an understanding of the dynamics of incremental processes, could not but have been aware that once a fundamental commitment is made, it is difficult to reverse. And while the initial space budget was relatively small, the acts of establishing a space agency and subscribing to the space goals were, in effect, supporting additional budget increments in future years. Of course, Congress and other societal decision-making bodies do make cumulative bit decisions without understanding the fundamental ones which underlie them, but, often, what appears to be a series of bit decisions is, in effect, the extension of a fundamental decision.

Incrementalists argue that incremental decisions tend to be small steps in the "right" direction, or, if and when it becomes evident that they are not,

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* Of course, one incremental decision should not be compared to a fundamental one, as only a series of incremental decisions constitutes an attempt to treat the same problem that is dealt with by a fundamental decision.

the course can be altered. But if the decision-maker evaluates his incremental bit decisions at all, which he must do if he is to decide whether or not they are "remedial," his judgment will be greatly affected by the evaluative contexts in which he views them. Here, again, we have to go outside the incrementalist model to ascertain the ways in which these criteria of evaluation are determined, which, we suggest, is very similar to the making of fundamental decisions.

Thus, while actors make both kinds of decisions, the number and role of fundamental decisions are greater than incrementalists hold, and when the fundamental decisions are absent, bit decision-making will amount to drifting, to action without direction. An active approach to societal decision-making requires two sets of mechanisms: (a) a high-order, fundamental policy-making process which sets basic directions, and (b) an incremental process which prepares for fundamental decisions and revises them after they have been reached. When rapid changes in the environment, in the societal unit, and in the step-structure nature of the problem, or prolonged mistaken treatment, lead to increasing difficulties, the higher order, fundamental review process must become operative.

Evaluating Decision-Making Strategies

The incrementalists argue that fundamental decisions tend to be poor decisions. Examples given are the Soviet decision to rapidly collectivize agriculture and French officers in Algeria deciding in 1961 to challenge the civil government's authority. It is asked, rhetorically, if it is possible to think of a single fundamental decision that was not poor? Remaining with these examples, the succeeding Soviet decision to decelerate collectivization and De Gaulle's decision to terminate the war in Algeria may be characterized as "good" fundamental decisions, as judged by the goals of the decision-maker at the time the decision was made, while it was carried out, and as it was implemented.*

The incrementalists further argue that without a comprehensive model for evaluation, "good" decisions cannot be defined, and that such a model cannot be generated. In contrast, we expect that the decisions actors make will be "better" (in terms of their goals), the more the actors adhere to a mixed-scanning strategy in their decision-making. While we recognize the serious difficulties in the evaluation of decision-making strategies, because factors other than these strategies affect both the decisions and their implementation

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* This qualification must be added because there always may be later unanticipated consequences which may upset the balance and tip it against the original decision. But since these may have further consequences that may restore the balance in favor of the act, a cut-off point is a pragmatic need of evaluation. It also is suggested that the more important consequences will tend to be visible in the time period specified above.

and, hence, make comparisons of strategies difficult, we see no reason for this being a more difficult evaluation problem than most others.[15] Finally, while it is difficult to rank and weigh the values or goals of an actor, it is not so insurmountable a problem as the incrementalists argue. We can ask decision-makers to rank their values, at least in an ordinal scale, or we can derive a weight from examination of their actual decisions and accompanying discussions.

Many societal projects, unlike actors or units, have one primary goal such as reducing population growth, economically desalting sea-water, reducing price inflation, or increasing economic growth. Although there may be other goals which are also served, they are secondary from the viewpoint of the project (though not necessarily from the viewpoint of some or even all of the participants). We thus may deal with the degree to which the *primary* goal was realized and use this as the central evaluative measure of a "good" policy, while noting the policy's effects on secondary goals. Thus, we can state that the introduction of birth control pills provides for more contraception (a primary goal) but less opportunity for nursing training (a secondary goal) than the diaphragm. When we compare projects in these terms, we, in effect, weigh the primary goal as several times as important as all the secondary goals combined.[16] When there are two or even three primary goals (e.g., teaching, therapy, and research in a university hospital), we can still compare projects in terms of the extent to which they realize each primary goal, and we can state, for example, that project X is "good" for research but not for teaching while project Y is "good" for teaching but not particularly "good" for research, and so on, without having to deal with the additional difficulties of combining the measures of effectiveness into one numerical index.[17] While this relatively primitive method of evaluation is not without its own problems or limitations, it more closely reflects what successful decision-makers actually do than the incrementalist description and seems to us to provide a more active basis for societal decision-making.

Not all outcomes have the same saliency for an actor, a fact which makes encompassing decision-making less difficult to assess than the incrementalists argue. Most actors, for instance, seem to rank survival above most other values. They also tend to rank the prevention of major *losses* of assets as more desirable than *gains* of the same or even higher magnitude. (Actors who command very few assets, however, are often an exception and tend to accept courses of action which entail much greater risks than richer actors.) Many other propositions may be generated about the distributions of goals (or "utilities") and the ways in which they are related to decision-making strategies.[18] It suffices to say here that such relationships *among* values (or goals) seem to be highly relevant to theories of guidance but are rarely explored in macroscopic and sociological perspectives.

A Morphological Comparative Approach

The more we recognize that the bases of decisions neither are nor can be an ordered set of values and a full examination of reality, the more likely we are to take into account that decisions are made through interactions among actors which are affected by the structures in which they take place. For instance, the choice of less versus more encompassing scanning is not merely an intellectual issue, a matter of strategic reflection, but is influenced by the relationships between higher and lower organizational ranks. If the higher-ranking decision-makers do not favor encompassing scanning, specific dysfunctions are expected, in particular excessive stress on instrumental considerations. Similarly, the conflicts between experts, especially of the analytic type, and high-ranking decision-makers reflect the conflicts among various levels of scanning. This conflict may be functional so long as the distribution of power between the two units assures the ultimate primacy of encompassing scanning. However, when external pressures lead to the placement of experts in a decision-making center, the consequences are often highly dysfunctional from the viewpoint of the units involved. An extreme example of this was when, in response to British and International Monetary Fund pressures, the advice of a tax expert, who was concerned with little other than tax revision, was forced upon the government of British Guiana in 1962 and led to mass riots and general strikes.[19]

The structural profile used here differs considerably from the one often advanced in writings on administration according to which higher-ranking men make general decisions while lower-ranking ones work out specifications within the framework of these general decisions.[20] According to this view, the decisions made by men of various ranks differ only in their degree of specification, and there is a clear hierarchization. In our model, the decisions of those lower in rank differ substantively from those of higher rank in that the lower-ranking decision-maker (a) tends to have a more instrumental orientation; (b) tends to promote one goal (at least relatively) while the higher and, especially, the highest decision-making ranks are concerned with balancing several goals; and (c) tends more toward the incremental approach.

A measure of the extent to which a societal unit is active vis-à-vis its own structure is the extent to which the elites and active publics view the decision-making organization itself as subject to review and alteration. Relatively passive decision-makers are often unaware of the effects of the internal structures of the decision-making centers on the decisions made. More active actors might be aware of these effects, but their perceptions of the difficulties of changing the structures might constrain them to omit such revision from the range of alternatives considered. Finally, highly active, transforming actors include "constitutional" reforms in their range of options. This is fairly common in organizations but less common in states. Of course, we do not mean "constitutions" literally; these are rewritten with

facility in some passive societies in which such rewriting does not involve changes in the decision-making organizations; actually, it may even serve to deflect attention from the fact that the organizations remain basically unchanged. Constitutional reforms, as understood here, entail changes in the institutional arrangements and procedures for making societal decisions. For instance, changes in the structure of representation are significant, to the degree that major decisions are made in and not outside of this structure.

The specific morphological approach taken here is a functional one—not one which assumes that all functions are always fulfilled, but one which suggests that if a decision-maker deviates markedly from the model, he will encounter specific dysfunctions whose nature can be derived from the elements of the mixed-scanning strategy he ignored. Scanning which is not sufficiently encompassing (which is the essence of the incrementalist approach) will tend to lead to relatively short-run, non-innovative, often costly decision-making. Such an approach may quite closely approximate what comprehensive rationality would dictate if the situation were stable and the actor's decisions (or policy) were initially effective, but it would be highly inappropriate if either the situation or the means available are rapidly changing—that is, if what were seen as crippling objections have disappeared rapidly, or new ones have risen quickly, or the policy that is being "incremented" was unrealistic when initiated.

In other words, there is no one effective strategy of decision-making in the abstract, apart from the societal context in which it is introduced and from the control capacities of the actors introducing it. The most effective strategy is the one that is most well-suited to the specific situation and to the actors' capacities. Rationalistic strategy is highly rigid; it provides the same basic prescriptions for all situations and all actors. The incrementalist strategy also claims general applicability, though it recognizes one minor sub-set of situations to which it does not apply—"large" decisions.[21] Mixed-scanning, too, claims universal applicability; its flexibility is achieved through changes in the relative investments in scanning in general (versus conduct not covered) and among the various levels of scanning. Thus, it calls for more encompassing scanning, the more transformable the environment and the actor.

Another major consideration here is the other capacities of the actor. An actor who is weak in the other elements of control—such as the capacity to mobilize power to implement or to communicate—may do better to rely on less encompassing scanning; even if remote outcomes are anticipated, he will be able to do little about them. On the other hand, there may be situations in which encompassing scanning may substitute for deficiencies in other control elements. Generally, we suggest, the greater a unit's control capacities, the more encompassing scanning it can undertake, and the more the unit undertakes such scanning, the more effective its decision-making.

This points to an interesting paradox: Developing nations, with much lower control capacities than modern nations, tend more to favor planning when they may well have to make do with a relatively high degree of incrementalism, while modern pluralistic societies—which are much more able to scan and, at least in some dimensions to control—plan less.*

Two factors highlight the differences in this regard among modern societies. While all modern societies have a higher capacity to scan because of their greater knowledge capacities, and while they all have some control advantages over non-modern societies, if only because they command better transportation and communication facilities, they differ sharply in their capacity to build consensus. Democracies must accept a relatively high degree of incrementalism (though not as high as that of developing nations) because of their greater need to gain support for new decisions from many and conflicting sub-societies, a need which reduces their capacity to follow a long-run plan. It is less difficult to reach a consensus, in non-crisis situations, on increments similar to existing policies than to gain support for a new policy. The role of crises, however, and their use in achieving major overdue reforms should not be excluded from the study of democracies. Crises are sufficiently important and frequent to merit systematic consideration. Specifically, we suggest, in relatively less passive democracies, crises serve to build consensus for major changes of direction which are overdue (e.g., the governmental guidance of economic stability, the welfare state, desegregation).

Totalitarian societies, which are more centralist and rely more on other kinds of power, which makes them less dependent on consensus, can undertake more planning, but they tend to overshoot their marks. Democracies tend first to build a consensus and then to proceed, often accomplishing less than was necessary later than was necessary. Their perennial problem is overdue change. Totalitarian societies, lacking the capacity to build consensus or even to assess the various resistances, usually try for too much too early and are forced to adjust their actions after the initiation of a plan because they only then discover its shortcomings and the lack of consensus. The revised policy is often less ambitious and involves more "consensus" than the original one. While totalitarian gross misplanning is a waste of human and capital resources, some initial overplanning and subsequent down-scaling is as much a decision-making strategy as disjointed incrementalism, and it is probably the strategy to which totalitarian societies, whose consensus-building machinery is ineffective, are best suited.

An active society will differ from earlier societies in its higher capacity for scanning (as a result of the development of knowledge-units), its higher

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* The paradox is even more accentuated when modern pluralistic societies demand master plans or, at least, encompassing planning from underdeveloped nations as a condition for receiving foreign aid, while the donors themselves do not practice such planning.

capacity for consensus-building (because of mechanisms explored below), and, hence, its higher capacity for planning and guidance. It, thus, would be less incremental in its decision-making than modern democracies but not as rationalistic as totalitarian societies attempt to be.

The Correlates of Decision-Making

We have outlined three alternative approaches to decision-making which relate to each other dialectically in that the incrementalist approach is antithetical to the rationalistic one, and mixed-scanning attempts a synthesis. Much remains to be said about the factors which affect the degree to which an actor can develop a decision-making strategy. Without attempting to treat all these factors here, we briefly illustrate those which link the study of decision-making directly to the study of some of the other factors we explore. They include: (i) the concept of slack, which ties the study of decision-making to that of asset analysis (which is examined in Chapters 13 and 14); (ii) the concept of lead-time, which links decision-making analysis with the concept of control (as introduced in Chapter 3); (iii) the extent of the differences in perspective between the elites and the societal unit (introduced in Chapter 5), which affects the quality of societal decision-making; (iv) decision-making strategies as part of societal knowledge (discussed in Chapters 6 to 9); and (v) the role of power in decision-making, which serves as a transition to the next two chapters.

Slack

Several studies of decision-making point to the existence of a "slack," some assets and energies that are not committed to any specific use but are available. The concept appears in studies of development as one *ad hoc* reason that the lagging sectors of an economy or a society are able to respond to pressures placed on them by an unbalanced plan.[22] If there were no slack upon which to draw, these lagging sectors could not accommodate without external support. The concept is also used in studies of the decision-making of corporations, in which it is defined as those assets and energies that the management is free to recommit as distinct from those which are so committed that they are unavailable under normal conditions.[23]

It is important not to confuse subjective with objective slack. If a decision-maker believes that he has at his disposal a certain amount of assets only to find that he cannot utilize them without generating severe strains in the sectors he deprives, his decision-making will be faulty. We, consequently, need to know whether or not there is an objective slack—i.e., by an observer's standards—and to what degree the actor is aware of this slack and is able to distinguish committed from uncommitted assets. Within broad limits, the

larger the objective slack, the more potentially active an actor. The actualization of this potential is significantly affected by the actor's awareness of its existence, location, and scope and by his capacity to mobilize his slack.

While the existence of a slack has many advantages, often discussed under the rubric of "strategic reserves," it tends to bias actors toward incremental decision-making because it conceals the contextual limits. For instance, it might be argued that a country in which the citizens are members of extended families and hold traditional values cannot be industrialized; there will not be the needed mobile labor force, and hiring labor and assigning jobs will be carried out on the basis of economically irrelevant considerations. But, it might be said, such countries often have efficient airlines. It might be concluded, therefore, that it is possible to proceed incrementally and introduce more modern industries, one by one. Actually, however, the successful airline may merely point up some slack in the system, atypical families in this case. The airline might be run by foreigners, by a minority, or by the few "modernized" families in the country.[24] Therefore, if an industrialist decides to establish other modern facilities, his plants will fail if the airline has exhausted the slack. This is more likely to happen, the less the actor is able to assess correctly the scope and kinds of slack in the system. More generally, slack tends to hide the lateral relationships because it allows one part of the system to be changed *without* adapting the others, leading the actor to neglect the treatment of the other parts only to be confronted with the reactivated system when the slack is exhausted. An incrementalist, we suggest, is more likely to neglect encompassing analysis and to ignore the initial signs of the exhaustion of the slack than is the mixed-scanner.

Lead-Time

The less encompassing the perspective of an actor, in terms of the links he takes into account, the less free to act he perceives himself. Some decisions have a genetic nature; that is, early ones create the conditions for later ones. The longer the series of decisions thus related, the longer the "lead time," the more important the anticipatory capacity of an actor for his active orientation. At each decision-making round, there are not only options among which the actor chooses but also conditions which—at this point—are, in effect, immutable. These, though, are in part the results of previous decisions, and, if their conditioning effect at this point had been taken into account earlier, they could have been partly shaped in accord with the actors' goals. Hence, the longer the lead-time, which is a dimension of the situation, the greater the need for the actor to scan in depth and to anticipate. For example, the management of monetary aspects of the economy, especially the attempt to anticipate the fluctuations of the business cycle and to act before depression or inflation has occurred, has been widely credited with reducing the mountains of inflation and filling in the valleys of depression in order to make the

fluctuations much less extreme. In contrast, the less anticipatory approach, which characterized pre-Keynesian management, was to increment remedially only after the crisis had occurred; this entailed a costlier guidance system.

When the structure of the situation is such that options are related genetically in long sequences but decision-making is incremental, crisis-management is likely to result. That is, when the inadequacy of a policy finally becomes obvious, large efforts are made to overcome the barriers which have been allowed to accumulate.[25] As the major longitudinal and lateral links have not been recognized, "fixing" one spot with large investments will often accentuate the strain on other parts of the system.[26]

All this does not imply that a rationalistic plan must be developed ahead of time and that all major future needs are to be anticipated, at point one in time. The deliberate maintenance of a slack, for example, is a way of taking into account the need for later accommodations, *without* necessitating specific knowledge of what they will be. Thus, slack and depth scanning are functional substitutes. (A further gain in the active orientation is to be expected when both are available.) At the same time, decisions vary in their lead-time; those concerning professional manpower, for instance, have a much longer lead-time than those regarding taxation.[27] An anticipatory capacity enhances activation only if it is applied to decisions and activities which are genetically related and if there is a parallel power to act; otherwise, the added capacity is not particularly useful.

Societal Units and Elites: The Decision-Maker's Values

Just as survival seems to be paramount in the hierarchy of values of most societal units, most decision-makers seem to assign a very high priority to their continued "survival" as decision-makers—i.e., to maintaining their elite position. It is not that most elites would deliberately violate basic societal values to stay in office (although history is not without such occurrences); the choices they make do not, as a rule, entail such extreme challenges. The values which are sacrificed for "political" considerations are often less central, such as loyalty to friends, candor, and fiscal integrity.[28] Moreover, decision-makers often argue that their continued stay in office is essential for the propagation of the basic values, some of which the elite "must", temporarily it is said, disregard. While occasionally there is a one-to-one relationship between the position of one elite and the realization of societal values, these statements are much more often ideological rationalizations which attempt to conceal a conflict of interests, values, and viewpoints between an elite and its societal base.

Elites, even relatively responsive ones, seem routinely to reveal a double standard in their decision-making, taking into account both societal and elite needs. Unresponsive elites, found primarily in societies and sub-

societies whose publics are relatively passive or have been inauthentically mobilized, are not those who have two sets of standards but, rather, those who take into account chiefly their own needs to the neglect of societal needs. The double-standard system entails screening out those alternatives which suit elite needs but not societal needs (e.g., the large-scale corruption of politicians), *and* those alternatives which serve the societal needs but undermine those of the elite (e.g., the introduction of necessary but "unpopular" programs such as an increase in taxation on the eve of an election). It is the elites who adhere chiefly to their own set of considerations that are known as the anti-social ones.

In stable societies, the double-standard perspective favors, under most conditions, an incremental strategy because it does not require the elites to undertake fundamental measures which are often politically dangerous (thus serving the elites' needs), while at the same time it seems to serve the societal needs.

Mixed-scanning, though, is a more effective strategy even from the viewpoint of a bifocal elite, because when incremental decisions are made in situations in which fundamental decisions are called for, the elite as well as the societal unit suffers. Actually, the elite's loss is often larger because the societal unit may accommodate by changing the elite, but the elite which is removed from office is often "fundamentally" powerless, at least for a period of time. President Truman, for instance, treated the cessation of the Korean War in a typically incremental fashion; General Eisenhower promised to terminate it at once, which was one reason for his election. The consequences of Truman's policy for his political career, friends, and advisers were non-incremental. Eight years later, President Eisenhower was charged with incrementing on the domestic front; Senator John F. Kennedy promised to get the country "moving again." Thus, in two instances, incremental administrations were replaced and the society initiated a basic change. Other examples include the Illia government in Argentina, 1963–1966, which was charged with incrementation before it was replaced; elite incrementation played a role in the replacement of Chamberlain by Churchill and in De Gaulle's replacement of the Fourth Republic. Effective decision-makers, thus, would seem to need a "rule" in their strategy: When necessary, stop incrementing and turn to more encompassing scanning and policies. (Of course, an elite cannot initiate a fundamental change just because it sees the need for one, but the elite's own decision-making strategy should not prevent it from seeing the need and attempting to act "fundamentally" when this seems in order.)

It has been argued that a well-functioning society moves back-and-forth between periods of accelerated change and consolidation (consolidation, in the terms used here, means incrementing within the context of fundamental themes that were established in the period of accelerated change). This entails either the same decision-makers' fluctuating between two "mixes" of

decision-making strategies, one less and the other more incremental, or a change of the elites in control.

Unless specifically encouraged to do so by his "strategy," a typical decision-maker will tend to exclude the possibility of his own resignation from the alternatives he considers; this possibility is ruled out by most elites' communities-of-assumption.* Actually, as De Gaulle has shown—when his ability for effective leadership was blocked in 1946 and he was losing the prestige he had acquired as a result of his war-time leadership—resigning might be not only the most normatively but also the most politically practicable alternative. It is an alternative which Clark Kerr did not use when he was caught between the California right and the student left, a situation which cost him much of his national stature. (He was mentioned much more often as a candidate for national office before the Berkeley crisis of 1964 than after it.) Resignation is a costly fundamental alternative that an incremental decision-maker tends not even to consider, but those who do consider it at major review occasions and occasionally are willing to take it are more able, we suggest, to advance fundamentally different policies when they are societally needed.†

The Societal Role of Theory

Decision-making is more open to influence by treatises about decision-making than most other societal processes are open to influence by any symbolic-intellectual input. Hence, the effect of theories on the actors must be taken into account not only on the normative grounds that any intellectual who affects the subject he is studying must consider, but also because otherwise, the analysis of the system is not complete; the theory-makers are part of the process of decision-making.[29]

While there seems to be little empirical data, Dror argued that the incrementalist theory enforces inertia and agitates against innovation.[30] Boulding pointed out that "whereas the theoreticians have hitherto tried to make them [the decision-makers] ashamed of their failures to be 'synoptic,' the present authors turn the tables and try to make the theorists ashamed of not having noticed that the practical men were right all the time."[31] Incrementalism legitimates remaining on the familiar path, a lack of encompassing scanning,

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* It would be difficult to test this statement because decision-makers occasionally threaten to resign but do not really consider doing so, or offer to resign but under conditions in which they expect their resignations not to be accepted. There is also a tendency to talk, usually in a light vein, about resigning: "I am sick and tired of it all." To test the proposition, a way would have to be found to distinguish an actual consideration of this alternative from a for-public-consumption one.

† Thomas B. Reed, the speaker of the House between 1889–1891 and 1895–1899, was a very effective leader. He is reported to have resigned in opposition to the Spanish–American War and United States imperialistic policies.

and adjusting goals to means—thus reinforcing the tendencies most decision-makers already have. This tendency to support the status quo and perceive it as needing, at most, amelioration is reflected in the incrementalists' use of basically the same set of statements to describe decision-making and to prescribe the strategy a decision-maker ought to follow. Thus, the incrementalists do not share in the critical function.

The incrementalists' counter-arguments are quite effective as far as they go. Implying that there are only two alternatives, incrementalist or rationalistic, they suggest that a decision-maker is in greater difficulty if he tries to be rationalistic because rationalistic conduct leads to frustration, paralysis, and, eventually, a rejection of the model. The model is too far removed from reality to have even a corrective effect.

While there is so far little evidence to test the following proposition, we expect that the mixed-scanning strategy is close enough to reality to be applicable but remote enough from it to provide a critical standard against which to measure differences among actors and changes in the decision-making of any one actor. The strategy of mixed-scanning generates demands for some scanning of the unfamiliar and for occasional reviews of alternatives excluded by the prevailing community-of-assumptions and refuses to sanction the adjustment of the ends to the means. The strategy also recognizes the function of leadership, of a decision-maker who is not merely a passive referee of existing pressures[32] but who mobilizes latent support for considerations that arise from his encompassing scanning.

There is a major tension in societal units between their normative commitments and the everyday pressures toward normative entropy; the decision-makers are in the center of this interplay, whatever strategy they follow. They may take no stand which, in effect, places them on the side of entropy. They may take a highly normative stand which, under many circumstances, will lead to their ceasing to be decision-makers. Or they may attempt to redress the balance in the direction of the societal unit's normative commitments, supporting and being supported by other anti-entropic forces. Active decision-makers seek such a balance; they never quite achieve it, but they have a net effect in favor of realization of the societal values.

The Role of Power

POWER AND KNOWLEDGE IN DECISION-MAKING

Societal decision-making is never a process in which means are allotted according to a systematic plan or policy; rather, it is a process in which a significant role is played by the relative power of the supporters of various societal goals and by the power of the decision-making elites and their goals.[33] Thus, the industrial management of a corporation—presumably more "rational" and less "political" than most elites—decides the relative weights of reinvestments, dividends, and wage increases not only on the

basis of how many assets the respective goals of industrial growth, capital investment, and labor mobilization deserve in accord with some abstract economic model, but also on the basis of how much pressure the governmental tax agencies exert on those who do not reinvest, how many large stockholders there are among the actual managers of the company, how well the workers are organized, etc. The same holds for the societal decision-makers, especially for the elites who guide the states, the political organizations of societies.

The role of power in societal decision-making can be empirically demonstrated when a change occurs in the relative power of the member-units; this tends to affect the decisions made by the system-elites.* Societal decision-making is, therefore, not merely a thought-process that balances goals and means but also a political process that balances various power vectors.[34] Each goal-and-means constellation has, in addition to its other relative merits, a different *political* weight.

The relative autonomy and power of the elites and the values to which they adhere also affect the societal decisions. Some elites are little more than "brokers" who register the relative power of the member-units and are instrumental in helping them to work out a joint policy.[35] Others have more power than all the member-units combined, although the members cannot, as a rule, be completely ignored. Many elites fall somewhere between these two extremes in terms of their power to affect societal decisions.

Second, decision-making centers, in the ways in which they are organized and function, often express value-commitments. In other words, certain alternatives are ruled out not because they are less rational or have less power "backing" than those which are chosen but because the decision-making centers consider them "unthinkable" or are so structured as to make them "unthinkable." While the relative power of the elites is indicated by the degree to which they can realize their preferences (as compared to following those of other units), their values are indicated by the content of their preferences. Decision-makers are rarely, if ever, completely neutral.

The struggles among agencies or services over their shares of the federal budget, among the various divisions of a corporation over the corporate "pie," and among the humanities, the social science, and the natural science faculties in a university are all parts of decision-making processes. In these processes, the various member-units use both arguments and power in terms of the next-level unit goals, whether they be the welfare of the nation, the corporation, or the university.

A member-unit which advances an alternative that is considered questionable in normative or knowledge terms will have to use much more of its power to gain the decision-makers' support than a unit which advances a

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* We mention system-elites because a change of the members' power will affect member-elites by definition. For a discussion of the two kinds of elites, see pp. 114–115.

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policy that is legitimate in terms of the system's values and goals and correct (or at least plausible) on the basis of available knowledge. On the other hand, it is quite clear that when a policy is illegitimate and when there are relatively valid arguments against it, elites will often implement the policy if enough power is exerted in its support. In short, values, knowledge, and power interact in the making of societal decisions and, to a degree, can be substituted for each other.

The relations between experts or knowledge-producing units and decision-making centers have a similar dynamics, although some interesting differences are to be noted. First of all, the knowledge unit's affiliation must be taken into account. Knowledge units themselves generally have little power and depend for allies on other participants in the political process. The allies may be one or more of the member-units that find the knowledge of political value to themselves. A decision-making center may use knowledge to reduce the counter-pressures exerted by member-units by showing them that experts believe their claims to be ill-founded. Any member-unit may have a knowledge-production sub-unit which may bias findings to suit the unit's needs or interpret the data in a way supportive of the unit. (For instance, public opinion polls are conducted not just "objectively" but also by candidates who wish to show that they have a reasonable chance of being elected.)* Decisions are, therefore, affected by the *relative* scope and skill of the use of knowledge units; the degree to which the decision-making centers command experts of their own to verify the arguments of member-units (e.g., Congress depends largely upon experts provided by the executive), and the degree to which the subject of the decision is given to reality-testing, affect the decision's relative "responsiveness" to knowledge, power, and normative commitments. Unaffiliated experts and intellectuals, as we have seen, become involved in the situation either through this "direct" political process or by gaining a following among one or more active publics.

It might be argued that power becomes important to decision-making in the form of an information input, and, hence, that the power analysis is reducible to an analysis of the knowledge processes.[36] The decision-makers take into account not only that unit *X* favors this course of action while unit *Y* favors another but also the units' power. Thus, changes in the relative power of a unit are registered as changes in the information input and, thus, are taken into account via the knowledge processes.

The influence of power on decision-making, however, is much more direct and intimate; its effects via channels other than the input of knowledge

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* External conditions, circumstances, or events account for conflict only insofar as the choices or decisions of the conflicting parties are influenced by observation or knowledge of these facts. The loci of the study of such conflict are, therefore, the psychological, sociological, political, and legal processes by which choices or decisions are made—that is, the minds of the decision-makers.

are sufficiently important for us to consider it, in addition to knowledge and normative commitment, as a third major determinant of decisions.[37]

There are two reasons for our position. First, knowledge about the relative power of the members of a system is at least as fractional as knowledge in general and probably more so. Hence, the decision-maker is likely to misjudge the power distribution if he assesses it on the basis of knowledge alone. But the power of a unit is not less because a decision-maker underestimated it, and the exercise of that power will affect the decision despite the fact that it has been underestimated. And while knowledge, even when it is accurate, can be ignored, power cannot. A decision-maker may choose—because of normative commitments, psychological rigidity, or intra-unit politics—to ignore facts, but—by definition—he cannot ignore power. An elected government can ignore information about an imminent coup but not the tanks crushing the gates of the Presidential palace. A President might ignore the information that Congress will not pass a bill he favors, but this will not alter the fact that when the vote comes, the bill will not be approved; the decision will be shaped directly by power.[38]

DECISION, POWER, AND IMPLEMENTATION

Decision-making falls between policy-formation and implementation. While decisions theoretically can be made without devoting any attention to the question of whether or not the actor has or can marshal the power needed to implement them, the effectiveness of a decision will depend as much on its power-backing as on the validity of the knowledge and the decision-making strategy which were used. Again, it may be said that power appears here as one other item of knowledge—namely, whether or not the actor correctly judged the power available for the support of this or that course of action. While this is true, power "appears" again in guises other than as items of knowledge. An actor may underestimate the power he can marshal—and, as we assume that decisions are made with only fractional information, such misjudgment is not to be viewed as accidental but as a central feature of the process—but he still commands that power and he may apply it once implementation is initiated.

If the decision-making and implementation processes could be neatly separated, decision-making might be conceived as a passive, reflective, powerless process and implementation as the application of power. The two processes, however, are closely interwoven, with decisions affecting implementations and initial implementations affecting later stages of decision-making which, in turn, affect later implementations. Decision-making is hence not to be viewed as a passive process—as exploring alternatives and choosing from among them. There is a continual give-and-take between decision-making and implementation. If decision-making were a "one-shot" affair, this give-and-take would be less manifest; but, in fact, decisions are processes and early decisions are often only vague directional signals, initial proddings,

or trial runs for later specifications and revisions. (Among other things, the actor is testing his power to gain his course before choosing which alternative he favors!)

Nor should the differences between the power which affects decisions and that which affects implementations be exaggerated. Early decisions shape the power which affects later decisions, and the more the initial decision took the relevant power into account, the more effective implementation is going to be. Thus, the pre-decision and post-decision environments are basically the same environment into which the controlling overlayers project themselves.

Finally, it should be noted that unless we add power analysis to that of decision-making, we do not know how decisions are related to the control of action. Let us take two actors who pursue the same decision-making strategy; one may be passive, reflective, and ineffectual, while the other is active, assertive, and effectual. The difference may be that one has less power than the other. Control is not just a process of information-collection, calculation, and the expression of commitments, but also a process of the mobilization and use of assets. Hence, all other things being equal, the more assets an actor has, the more effective will be his decisions. In addition, the nature of his decisions will change in terms of how relatively significant *additional* knowledge is, how careful he must be in making his initial decisions (which are those most likely to need revision or correction), how much "waste" he can afford, etc.

In Conclusion: Decision-Making and the Active Orientation

It might at first be expected that the more rationalistic an actor's decision-making, especially if his rationality is comprehensive, the more active he will be. The rationalistic strategy calls for adjusting means to a set of goals to bring about goal-realization, and its comprehensiveness would seem to assure that one goal will not be advanced to the neglect of the others or of the secondary needs of the actor. What, in theory, could be more active than that? The reason we expect more active actors not to adhere to more rationalistic decision-making strategies is that these strategies are not rational at all; as the incrementalists correctly stressed, the rationalistic approach does not provide a guidance mechanism for relating means to goals and realizing values. Moreover, rationalistic decision-making hinders effective action because, as we have seen, the prerequisites of the model cannot be met in the real world. A decision-maker who attempts to follow the model (as distinct from one who uses the model to legitimate the different procedures he actually follows) will either weaken his own commitments, as his resources and energies are spent trying to apply a model that he cannot satisfy, or will overact and initiate policies that he will assume are rational, only to discover

that the policies do not withstand reality-testing and that he knows and controls less than he assumed. In both cases, the actor is expected to be frustrated and relatively inactive.

Incrementalism, we suggest, has effects that are surprisingly similar to those of rationalistic decision-making, though according to many viewpoints, it takes the opposite tack. For reasons discussed above, incrementalism encourages relative inactivity by its central tenet that the next decision-making situation will be like the last one, and by its assumption that the actor is unable to set a goal of any remoteness and generality and pursue it with any measure of effectiveness. An incrementalist actor responds and adjusts; he does not even try to transcend and transform.

Mixed-scanning allows for greater realization of goals than either the rationalistic or the incremental approach, and its requirements can be met. The combination of bit-incrementation with contextual decision-making provides both a short-run probing and a long-run criterion for evaluation, both a realization of the inability to take into account all alternatives *and* a "trigger" mechanism to recall broader considerations when necessary. Above all, it allows for linking the transcendental setting of goals to attempts to transform an existing societal unit, without which activation cannot reach its full measure.

When actors faced with the same situations and possessing the same societal assets and control capacities apply different decision-making strategies, we expect significantly different degrees of effectiveness; i.e., this variable is more powerful than more collectivistic theories imply.[39] While we suggest that most actors would do better by using mixed-scanning in most situations, there are differences in the degree of loss entailed in following other strategies and in the kind of mix of bit and contextual scanning which is most fruitful. In general, the less malleable the environment or the actor and the fewer the available resources, the less damage incrementalism will cause (and the less encompassing scanning is needed if a mixed-scanning strategy is followed). The more malleable the situation and the actor and the more resources available, the more dysfunctional is incrementalism and the more encompassing scanning is called for in the decision-making mix. The rationalistic approach, on the other hand, seems inappropriate in both circumstances, as in neither case can its requirements be even approximated. That both incremental and rationalistic strategies are frequently pursued is true, but this is also one reason that most societal actors are not highly active.

NOTES

1. While economists have used rationalistic models in giving macroscopic advice, it is not clear to what degree their advice is really derived from such a model, and it seems that the decision to follow, reject, or mix the advice with other considerations is not based on such models, and less rationalistic models are often used. Paul A. Samuelson, "What Economists Know," in Daniel Lerner (ed.),

The Human Meaning of the Social Sciences, *op. cit.*, pp. 183–213. It should be noted that there are many assertions about the role of economic models in policy-making but much fewer empirical studies of their effects.

2. Quoted in Lindblom, *Public Administration Review*, Vol. 19, *op. cit.*, p. 80. Lindblom adds that the "claim that operations research is for low-level problems is widely accepted."

3. This procedure is used by the Israeli Army. Personal observation.

4. Personal communication with Professor Lloyd Motz, Professor of Astronomy at Columbia University. A similar camera system is employed in the Lunar Orbiter spacecraft. A "wide-angle" lens is used to produce overlapping pictures of large areas of the moon's surface. At the same time, a telephoto lens is used to reproduce small-scale surface features. This procedure is designed to yield the maximum of topographic information—general terrain and specific details—about possible lunar landing sites. See Press Release on Lunar Orbiter 3, *National Aeronautics and Space Administration* (January 31, 1967), p. 22.

5. Elie Abel, *The Missile Crisis* (Philadelphia: Lippincott, 1966), pp. 17–32, esp. p. 26.

6. For indirectly related works see A. D. deGroot, *Thought and Choice in Chess* (The Hague: Mouton & Co., 1965), pp. 271–274; Ernest Jones, "The Problem of Paul Morphy: A Contribution to the Psycho-analysis of Chess," *International Journal of Psycho-analysis*, No. 12 (1931), pp. 1–23.

7. This is by no means obvious or self-evident. Hirschman and Lindblom argue, that such scanning would make an actor ideologically rigid and would reduce his effectiveness. "Economic Development, Research and Development, Policy Making: Some Converging Views," *op. cit.*, p. 218.

8. I am indebted to Nelson W. Polsby for the suggestion to present the strategy in the form of a linear program and for some of the specific "instructions."

9. For our view of the context of this period, see Amitai Etzioni, *The Hard Way to Peace: A New Strategy* (New York: Collier, 1962), Ch. 1; for evaluation of the results, *Winning Without War* (Garden City: Doubleday, 1964), pp. ix–xiii, 1–27, and *passim*.

10. Braybrooke and Lindblom, *A Strategy of Decision*, *op. cit.*, pp. 62–65. The concern here is largely with the United States. Hirschman extends this position to developing nations. *Journeys Toward Progress*, *op. cit.*

11. Richard F. Fenno, Jr., *The Power of the Purse* (Boston: Little Brown, 1966), pp. 266 ff. See also Otto A. Davis, M. A. H. Dempster and Aaron Wildavsky, "A Theory of the Budgetary Process," *The American Political Science Review*, Vol. 60 (1966), esp. pp. 530–531; Wildavsky and Hammond, "Comprehensive versus Incremental Budgeting in the Department of Agriculture," *op. cit.*

12. Nelson W. Polsby, *Congress and the Presidency* (Englewood Cliffs, N.J.: Prentice-Hall, 1964), p. 86.

13. *Ibid.*, p. 86. While this decision itself had some "preparatory" bits and post-hoc specifying ones, a fundamental decision was made in 1950. For a discussion of a contextuating decision by the United States Supreme Court on desegregation which was then "spelled out" in a long series of incremental decisions, see Shapiro, "Stability and Change in Judicial Decision-Making," *op. cit.*, esp. pp. 145–146.

A decision-maker may make a fundamental decision when he intends to make an incremental one, for instance, if he wishes to keep his decision "minimal" and

leave as many options open as possible. See Schilling's discussion of how President Truman's decision to "determine the technical feasibility of a thermonuclear weapon" led to Hiroshima. Schilling, "The H-Bomb Decision: How to Decide Without Actually Choosing," *op. cit.*, esp. pp. 36 ff. Bruce L. R. Smith pointed out that the distinction between incremental and fundamental decision-making was not completely clear. See his communication to *The American Political Science Review*, Vol. 61 (1967), esp. p. 151. See also rejoinder by Davis, Dempster and Wildavsky, *ibid.*, pp. 152–153.

14. Polsby, *loc. cit.*, p. 83.

15. For a discussion of evaluation techniques, see Herbert H. Hyman, Charles R. Wright and Terence K. Hopkins, *Applications of Methods of Evaluation* (Berkeley: University of California Press, 1962). See also Peter Rossi, "The Study of Man: Evaluating Social Action Programs," *Trans-action*, Vol. 4 (June, 1967), pp. 51–53.

16. David Osborn, Deputy Assistant Secretary of State for Education and Cultural Affairs is reported to have devised a method for such calculations with regard to the multiple purposes of cultural exchange programs. See Virginia Held, "PPBS Comes to Washington," *The Public Interest*, No. 4 (Summer, 1966), pp. 112–113. See also Elizabeth Drew, "HEW Grapples with PPBS," *The Public Interest*, No. 8 (Summer, 1967), pp. 9–29.

17. For additional discussion, see Amitai Etzioni and Edward W. Lehman, "Some Dangers in 'Valid' Social Measurement: Preliminary Notes," *The Annals of the American Academy of Political and Social Science*, Vol. 373 (Sept., 1967), pp. 1–15.

18. For studies on the computing of societal "utilities" see Ward Edwards, "The Theory of Decision Making," in Rubenstein and Haberstroh, *Some Theories of Organization*, *op. cit.*, esp. pp. 404–408. For surveys of quantitative developments, see Robert Schlaifer, *Probability and Statistics for Business Decisions* (New York: McGraw-Hill Book Company, 1959); Herman Chernoff and Lincoln E. Moses, *Elementary Decision Theory* (New York: Wiley & Sons, Inc., 1959); R. M. Thrall, C. H. Coombs, and R. L. Davis, *Decision Processes* (New York: John Wiley & Sons, Inc., 1954). See also, Marcus Alexis and Charles Z. Wilson, "Quantitative Decision Models," in their *Organizational Decision Making* (Englewood Cliffs, N.J.: Prentice-Hall, 1967), p. 222–255.

19. See *The Economist*, Vol. 202 (February 24, 1962), p. 693. For additional discussion see Bertrand de Jouvenel, "Political Science and Prevision," *American Political Science Review*, Vol. 59 (1965), p. 30.

20. Simon, *Administrative Behavior*, *op. cit.*, rev. ed., pp. 245–246.

21. Braybrooke and Lindblom, *A Strategy of Decision*, *op. cit.*, pp. 66–69.

22. Hirschman, "Unbalanced Growth: An Espousal," *The Strategy of Economic Development*, *op. cit.*, pp. 62–75.

23. Cyert and March, *A Behavioral Theory of the Firm*, *op. cit.*, p. 36 and *passim*. Other studies which use the notion include Roscoe C. Martin, Frank J. Munger et al., *Decisions in Syracuse* (Garden City, N.Y.: Doubleday, 1965), pp. 8–10.

24. This applies, for instance, to the airlines of Peru and of several Central American Republics. For another example, see David Corbett's discussion of Indian airlines in his *Politics and the Airlines* (London: George Allen & Unwin Ltd., 1965), pp. 303–323. The same point applies to Egypt's capacity to effectively run the Suez Canal but little else.

25. Anne Gibson Buis concludes a study in 1953 with the statement, "The

records reveal that the Congress has seriously considered federal aid to education bills only during periods of national stress. . . ." Quoted by Frank J. Munger and Richard F. Fenno, Jr., *National Politics and Federal Aid to Education* (Syracuse, N.Y.: Syracuse University Press, 1962), p. 181. The quotation is from "An Historical Study of the Role of the Federal Government in the Financial Support of Education, with Special Reference to Legislative Proposals and Action" (unpublished doctoral dissertation, Ohio State University, 1953), pp. 659–660. The Sputnik crisis is said to have produced such a momentum. Munger and Fenno, *op. cit.*, p. 182. See also Homer D. Babbidge, Jr. and Robert M. Rosenzweig, *The Federal Interest in Higher Education* (New York: McGraw-Hill, 1962), pp. 18–19.

26. Examples would include the attraction of students to study "space sciences" following the orbiting of the Sputnik in 1957, which generated a decline in the number of applicants to medical schools and, hence, in the quality of students in these schools, without significantly increasing the total number of students in graduate schools. Personal communications with deans of medical schools.

27. See *supra*, pp. 213–214, Ch. 9.

28. Alexander L. and Juliette L. George, *Woodrow Wilson and Colonel House, A Personality Study* (New York: Dover, 1964), pp. 166–167. See Robert Michels, *Political Parties, op. cit.*

29. There is much debate about the degree to which strategies affect the world of the decision-makers. Anatol Rapoport, for example, takes an extreme position. See Anatol Rapoport, *Strategy and Conscience* (New York: Harper & Row, 1964); Rapoport, "The Sources of Anguish," *Bulletin of the Atomic Scientists*, Vol. 21 (December, 1965), pp. 31–36. See also Donald G. Brennan, "Strategy and Conscience," *ibid.*, pp. 25–30.

30. Dror, "Muddling Through—'Science' or 'Inertia'?," *op. cit.*, p. 155. See also Richard A. Lester, "Economics Includes Politics," *The Yale Review*, Vol. 43 (Autumn, 1953), p. 147.

31. Kenneth E. Boulding, review of *A Strategy of Decision*, in the *American Sociological Review*, Vol. 29, *op. cit.*, p. 390.

32. Cf. Latham, *The Group Basis of Politics*, *op. cit.*, p. 390.

33. While within a person too there are different levels of support for various goals and for controlled versus ongoing behavior, the differentiation is much less articulated. The same holds for the average micro-unit.

34. Cyert and March, *A Behavioral Theory of the Firm*, *op. cit.*, pp. 27–32 and pp. 284–286.

35. Latham, *The Group Basis of Politics*, *op. cit.*, viewed all elites in this way.

36. "External conditions, circumstances, or events account for conflict only insofar as the choices or decisions of the conflicting parties are influenced by observation or knowledge of these facts. The center for the study of conflict is, therefore, the psychological, sociological, political, or legal processes by which choices or decisions are made—that is, in ordinary terms, the workings of the minds of the decision-makers." Quincy Wright, "International Conflict and the United Nations," *World Politics*, Vol. 10 (1957), p. 26. See Lewis F. Richardson, *Generalized Foreign Politics: A Study in Group Psychology* (Cambridge, England: The University Press, 1939); Charles Horton Cooley, *Human Nature and the Social Order* (New York: C. Scribner's Sons, 1902); Kurt Lewin, *A Dynamic Theory of Personality* (New York: McGraw-Hill, 1935); Frederick C. Barghoorn, *The Soviet*

Image of the United States: A Study in Distortion (New York: Harcourt, Brace, 1950). See also Peter Bachrach and Morton S. Baratz, "Decisions and Nondecisions: An Analytical Framework," *The American Political Science Review*, Vol. 57 (1963), esp. p. 633.

37. Simon, *Administrative Behavior*, *op. cit.*, includes only information and values.

38. Access to power has a particularly important effect on governmental decision-making. For an example see Everett E. Hagen and Stephanie F. T. White, *Great Britain: Quiet Revolution in Planning* (Syracuse, N.Y.: Syracuse University Press, 1966), esp. pp. 62–88.

39. Orville G. Brim, Jr. et al., *Personality and Decision Processes* (Stanford: Stanford University Press, 1962), pp. 233–235.

CHAPTER 13

Power as a Societal Force

WHILE IN the reality of societal action cybernetic factors and implementing factors are mixed, it is useful to treat the two kinds of factors separately for analytic purposes. If we imagine two actors who are committed to the same goals, whose cybernetic capacities are identical, and who operate in the same environment, the major difference in the degree to which their goals will be realized will be explained by their capacity to implement their decisions, which will be greatly affected by their relative power. In this chapter, we first briefly explore the question: Can power be defined as an operational concept? How important is power in the regulation of societal processes—is it a universal component of all societal organizations or found only in deficient ones? We then ask: What is the relationship between the distributive structure of society and the societal role of power? What is the relation of stratification to political processes? In the closing section of this chapter, we discuss the relationship between power and the other main implementing factor, communication. We ask: To what degree can communication substitute for power in an active society?

The Societal Scope of Power

Power Defined

The realization of most societal goals, even in situations in which the actor's commitment and knowledge are considerable, requires the application of power. That is, under most circumstances, societal goals and decisions not supported by at least some degree of some kind of power will not be implemented. Hence, powerless actors are passive actors. The assumption which underlies these statements is that the realization of a societal goal requires introducing a change into societal relations, either in the societal environment or among the member units, and, as a rule, attempts to introduce changes (as distinct from changes that occur "anyhow," which do not constitute the realization of a goal), encounter some resistance. Unless this resistance is reduced, a course of action set will not be a course of action followed. *Power is a capacity to overcome part or all of the resistance, to introduce changes in the face of opposition* (this includes sustaining a course of action or preserving a status quo that would otherwise have been discontinued or altered).[1]*

Power is always relational and relative.[2] An actor by himself is not powerful or weak; he may be powerful in relation to some actors in regard to some matters and weak in relation to other actors on other matters. Here, we are interested chiefly in the macroscopic consequences of the application of power; hence, we are concerned with societal power and not with the power of individuals or small groups, although several of the following statements and propositions apply to these units as well.

Power as an Operational Concept

There has been considerable controversy about the definition of power for centuries.[3] Without attempting to review this controversy here or to deal with its many issues, let us briefly indicate our position on the question of whether or not the methodological difficulties involved in the use of the concept can be surmounted. The main methodological objection to the use of the concept of power is that power can be assessed only *post hoc*; we know that x has power only after he overcomes the resistance of y, and whether or not he can do so—it is said—is unknown until after he has done it.[4] Such *post hoc* analysis has no predictive value. To avoid this difficulty, let us use "power" not for a single exercise of it on a single issue over a single subject at one point in time, but rather to refer to a generalized capacity of an actor, in his relations with others, to reduce resistance to the course of action he

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* Reference notes for this chapter appear on page 342.

prefers in a given field (i.e., in the "presence" of other actors) about a set of matters over a period of time.[5] This capacity can be anticipated with a certain degree of probability; on the basis of past instances of the exercise of power, the outcomes of future applications of power can be predicted.[6] Even before an instance of the exercise of power has occurred, we can make probabilistic statements about the expected outcome. These are based on our estimates of the relative assets and the uses made of them by the actors in a given field, which can be studied before power is applied.

All of this is possible once the distinction between assets and power is recognized. Assets are possessions of an actor which *may* be converted into power but are not necessarily so used; hence, there is a systematic difference between the assets of an actor, which may be viewed as a power base or potential, and his actual capacity to reduce the resistance of others, which is the power actually generated. ("Potential" refers to the latent energy "locked-into" the societal "material"; "actual" capacity refers to the energizing itself.*) If assets and power are viewed as analytically identical, it is impossible to use the one to formulate predictions about the other.

There are three reasons that the concept of power as a generalized capacity that draws on an asset base but is not identical with it, is particularly useful. First, analysis becomes more realistic. When, for a particular line of action, an affluent actor does not mobilize more than a small fraction of his assets and thus loses to a poorer but more mobilized actor, this, in itself, often leads to a greater mobilization of the affluent actor and, in the long-run, to his "victory." Atomistic power analysis, focusing on each instance of the exercise of power, would not be able to account systematically for the interplay between the loss of single campaigns and the winning of the whole drive.[7] Collectivistic power analysis, focusing on differences in assets, may expect the affluent actor to prevail initially.[8] Neither approach would alert the observer to the fact that in situations in which there are only a few rounds and the outcome is irreversible, the poor but highly mobilized actor who generated more power in the critical instance will tend to prevail. This applies, for instance, to movements of revolution or national independence (in systems which are poorly integrated) and to the passing of key legislation (in systems which are better integrated).

The second reason that the concept of power as a generalized capacity is particularly useful concerns the cross-sectoral application of power. Much has been said about the sectoral nature of power—that it cannot be deduced that an actor powerful in one area of societal activity will be powerful in other areas; again, the concept has been declared too fragmented to be fruitful. While we agree that power in one sector (e.g., in economic matters) does not necessarily imply power in others (e.g., in religion), there is nonetheless some halo effect; that is, the very capacity to have one's way in one

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* For discussion of the energy model, see pp. 35–36.

area generates a degree of superordination in another area.[9] An example used to illustrate the sectoral nature of power actually illustrates its intersectoral, generalized character as well. The United States, it is said, has a very large amount of economic assets and military power in comparison to small countries, but in terms of votes in the General Assembly of the United Nations, all this power is to no avail, since the United States has only one vote like the smallest, poorest, and militarily weakest country.* Actually, the fact that the United States has economic power over the Central American republics, for instance, greatly influences the votes of these republics in the General Assembly. Obviously, when one of them introduces a resolution that is incompatible with a major tenet of United States policy, that republic has a much more difficult task in making the United States vote in accord with it than the other way around. This is the case because power relations outside the General Assembly and in sectors of international relations which ostensibly are quite unrelated to it, such as the marketing of primary products, greatly influence relations within the General Assembly. This, we suggest, is in part because power in one sector tends to invoke some power in other sectors (although, as a rule, not commensurate) and in part because power in one sector can be "cashed" in another sector, in the sense that votes in the United Nations can be "traded" for, let us say, an increase in the sugar quota. Thus, an actor whose generalized power is greater will enjoy an advantage over the less powerful actor even in sectors where there is formal equality. The concept of generalized power calls our attention to these power projections.

A third reason that this concept seems useful is that it explains submission even when there is no actual exercise of power. This is because the subjects' considerations—like the application of power—are probabilistic; a small nation or a group of workers refrains from resisting not because it is certain that it will be punished (or, not rewarded) if it were to block the power wielders' course, but because the probability of being treated punitively is higher than it is willing to accept. On the other hand, if the controlling agents cannot exercise sanctions at least occasionally, their power will erode and resistance will rise, as subjective probabilities are adjusted. For all these reasons, in the following discussion "power" means a *generalized* capacity to reduce resistance.

Like energy, power is directly observable only when used. The power of a unit can be predicted by studying its assets, its total structure, and its past performances in this regard. But like the world of physical energy, there is no gain-for-nothing, for power has a cost; assets used to generate it are no longer available to the particular actor. If the asset base is not replenished, the probability of compliance will decline.

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* Leland M. Goodrich, *The United Nations* (New York: T. Y. Crowell, 1959), pp. 124–125.

Our concept of power is not tautological. While no power was exercised unless resistance was reduced, resistance may be reduced in other ways—for instance, by authentic consensus-formation. Secondly, while two actors may apply the same amount of power, we shall see in the next chapter that differences in the kinds of power used affect the conditions under which resistance is reduced, which, in turn, affects the active quality of the societal unit. All of this is not to suggest that the concept of power presents no difficulties, but that its merits for socio-political analysis outweigh its shortcomings.[10]

Is Power Universal?

The concept of power has provoked many debates concerning the socio-political stance it implies. As the concept is used here, the notion of resistance is central. The socio-political world implied is one composed of a plurality of societal actors, many of whom are committed to realizing one or more goals. Scarcity, we assume, prevails in the sense that the total amount of assets available is smaller than that needed to realize all of the goals of all of the actors. (Overcapacity or "affluence" might exist in this or that instrumental realm but is never universal.[11]) Nor are all or even most of the goals of the actors shared or complementary. Hence, while the realization of some goals does not distract from the realization of some others and may even advance them, there is a significant degree of incompatibility among goals (in that the realization of some goals limits the realization of some others) and among means (in that the use of most means for most goals makes these means unavailable for the advancement of any other goal).

From the facts that there is a plurality of actors and of goals and a scarcity of instruments, it follows that societal actors will tend to "resist" each other in the sense of hampering each other's actions. This is not to imply, as has been suggested, that conflict is the prevailing mode of societal relations. Actors often do share some goals and work out a set of priorities among some other goals and a pattern of allocation of scarce instruments. But even if such cooperation and mutual understanding were eventually to encompass the full range of societal action (a situation hard to imagine), the specific pattern of priorities and allocation would still reflect the relative power of the various actors. The agreements reached between an adolescent and his parents, a new nation and a superpower, the poor and City Hall are almost invariably a-symmetrical, as indicated both by the respective implementations of divisive (as distinct from complementary and shared) goals and by the respective shares of the scarce instruments and rewards obtained. (On the rare occasions that symmetrical arrangements are reached, they do not reflect a power vacuum but arise from the equally rare power situation in which the various actors command almost equal amounts of

power.*) In cooperative relations, power appears in the ability to eliminate all arrangements which differ from those finally reached. It is true that some concessions are made because of non-rational commitments to shared values—for instance, national pride. Also, in part, the arrangements reached reflect the sides' *estimates* of the outcome of a more explicit use of power. But while the outcomes of negotiations or arbitration rarely reflect only the sides' actual relative power, they usually are significantly affected by it—if not in each round, as the rounds accumulate.

Another reason that power and cooperation are fundamentally related is that patterns of cooperation are not worked out on an *ad hoc* basis or completely voluntarily among the actors concerned; cooperation is often imposed by third parties or is institutionalized and enforced as the result of previous arrangements among the actors. For instance, the degree of cooperation among the republics in Central America in part reflects the power the United States has over them; the degree of cooperation between management and labor is affected by the power the national government has over them as well as by enforceable agreements between them. Power and cooperation are, thus, not a mutually exclusive pair of concepts; cooperation often has a power base, and power is exercised through cooperation.

The tendency to associate power with conflict rather than with cooperation is part of a more general tendency to view power negatively. Hence, it should be emphasized that at least in macroscopic social structures, the realization of many values depends on a "proper" power constellation rather than on the elimination of the role of power.[12] Thus, for instance, democratic processes presuppose a plurality of power centers, each strong enough to compete with the others but not so strong as to be able to undermine the societal framework in which the democratic competition takes place. And in societies in which the law prescribes civil and human rights for its members, the effective safeguard of these rights only in part rests with societal education and in the identification of various members with these values; they need also to be supported by at least a latent capacity for any group of citizens whose rights are denied to exert sufficient power to activate the societal mechanisms necessary to restore their rights. The same holds for "free enterprise" and "free" markets; they may exist between units similar in economic power but not between oil companies and gasoline stations or between automobile manufacturers and automobile dealers.[13] To put it differently, the power relations among the member-units of a society and between that society and other societies are a major determinant of the degree to which that societal structure will be consonant or in conflict with the values to which the members "individually" and as a collective unit are

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* The only situation in which all the actors have *exactly* the same amount of power over each other is when none has any. Complete equality, a "limit" situation, is, hence, the only societal situation which is powerless.

committed. In short, effective universalism is not to be expected without an appropriate power distribution.

While power and conflict are not Siamese twins, they are intimately connected and frequently appear together. One reason that conflict is a common mode of societal relations rests in the poor societal knowledge most actors have of their potential power as compared to that of other relevant actors. The sources of societal power are many and varied and include such intangible elements as the capacity of a societal unit to mobilize the loyalties of the membership and the efficacy of its organization and elites. Therefore, it is usually difficult for even a detached observer to assess accurately the power of various actors, and when the assessor is himself an actor in the field, the reasons for misjudgment multiply. If the relative power of various societal units were completely measurable, and if there were a supreme judge who could adjust the patterns of priorities of shared projects and the allocation of assets not committed to shared projects—to the changing power assessments—societal conflict would be greatly reduced; a basic function of societal conflict is to substitute for the lack of such measurements and judges.[14] Societal conflict is, therefore, an inherent element of macroscopic processes. It is a major (although by no means the only) expression of power—of the discrepancy between the capacity of an actor to produce change and the readiness of other actors in the field to agree, between the actual distribution of societal power and that which the prevailing stratification structure and political organization of society assume.[15]

Power relations seem to be an inevitable feature of societal structure. It seems that there will always be a plurality of actors, each with a will of his own that is not completely complementary to, or shared, by all other actors, even if they all are members of one community. While the *intensity* of power —the extent to which societal relations are regulated by it—might well decline as the scope of shared values and authentic consensus broadens, so long as there is a scarcity of assets and societal actors have a degree of autonomy, some actors will meet with some resistance from some other actors and will use part of their assets to reduce it in order to further their own goals.[16] Although active societies may be less power-oriented than modern ones, they will not be without the application of power between members and by the controlling overlayer over the underlayer.

To make power a central element of societal analysis is not to assume that other elements—especially goals and values, knowledge and commitment—are less important. On the contrary, we view societal power as a form of the mobilization of societal energy in the service of societal goals. Political elites might seek power for power's sake or, perhaps more accurately, rank the gaining of the instruments of power higher than any other particular goal they seek[17]; but the societal consequences of power lie in the realization of societal goals, whether they be changes in the relations of the societal unit to its environment or the transformation of the societal self. To say that power is a

universal feature of society is not to imply that power is omnipotent. A major limitation to power is the values to which actors are committed; actors restrain the use of power under certain circumstances because elites as well as followers *believe* they ought not to use whatever power they command in every situation.

Second, the power of any societal actor, however great, is limited by that of others. Writings in the "power-elite" tradition tend to overestimate the degree to which the power of business or the "military–industrial complex" is autonomous and unchecked.[18] The narrow range of the power of American Presidents is well known,[19] and the limitations on the power of even totalitarian leaders and parties are well documented.[20] Power can be exercised only because—and to the extent that—the power potentials are unevenly distributed among the actors.

Between Power and Coercion

To generate power is not necessarily to rely on force or to be coercive.[21] That there are other sources and means of power—for instance, economic assets—is too obvious to need comment. It is sometimes argued that all other kinds of power "ultimately" rely on force because it is used when economic or moral sanctions fail.[22] While there are cases in which this is true, there are others in which force is not applied even though economic or moral sanctions were not heeded as, for example, in numerous business and interpersonal transactions and relations. Second, even when there is force "in the background," the other sanctions clearly play an autonomous role, for instance, in the likelihood that force will need to be applied.

What is less evident is that although power, by definition, assumes a capacity to reduce resistance, it is not necessarily coercive in the sense of eliminating all or most alternatives to the course imposed on the actors who are subjected to the exercise of power. Of course, power may be coercive; more often, however, power takes effect indirectly by altering the situation. Rather than preventing those subjected to power from following a course of action, it makes the course less attractive (and, by implication, the other alternatives more attractive). Here, the actors still can—if they are willing to pay the higher costs—pursue their original courses. Since few if any acts are without costs (even when these are outweighed by gains), the more common effect of the injection of power into a situation is to alter the costs rather than to destroy the capacity to choose. That is, there is frequently a voluntary element in submission: the unwillingness to pay the cost of not submitting.

Complete coercion occurs when the subjects are, in effect, deprived of the opportunity to choose—e.g., when a parent carries a child away from his toys, or when United States forces physically prevented Cuban exile organizations from raiding Castro's Cuba in 1963 by arresting the leaders and impounding the boats. It has been argued that even in the most coercive

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situation, the actors have a choice; they can choose to die rather than submit. It is a fact, though, that coercive controls are typically used to foreclose this option, too—to force the subjects to live in jail. The same may be said of collectivities under extreme totalitarian conditions.

There are situations which approximate this extreme case in which, in effect, alternatives are eliminated and the available choices are very skewed—e.g., there are only two alternatives and the penalty of choosing one of them is very high. Therefore, it seems useful to treat the concepts of coercion and non-coercion not as a dichotomy but as points on a continuum. Accordingly, coercion is used to refer to compliance relations in which there is little or no effective choice. Non-coercive compliance includes utilitarian and normative relations. By this definition, some but by no means all or even most power is coercive, initially or "ultimately."

Another reflection of the liberal tendency to evaluate power negatively, apparent in the inclination to make all power seem coercive, is the focusing upon the illicit uses of power.[23] Actually, power might advance any societal goal, from conserving a status quo to altering it. The notion that evil is imposed by power while goodness flies on its own wings assumes an optimistic view of human nature and societal institutions that has little evidence to support it. The application of power is a principal way of getting things done. Its ethical standing depends in part on the kinds of things that get done and on the ways in which goals are set and attained; these factors, in turn, depend much more on the distribution of power (what proportion of the members of a unit to which power is applied shares in setting the goals?) and on the amounts and kinds of power used (e.g., the degree of coercion) than on the very fact that power was exercised. *Hence, most societal actors must choose not between getting things done voluntarily or through the exercise of power, or between exercising power or not getting things done, but rather among the varying degrees and kinds of power to apply.* A societal unit is more active the lower the intensity of the application of power, the more societal action is based on authentic consensus, and the less alienating the kinds of power used.

The Stratification Bases of Power

Theories of societal action can be characterized according to the degree to which they use a class or an elite approach. We refer to the first as a stratification approach to emphasize that societal units or sub-units which have similar status in terms of the allocation of assets may be regional or ethnic groupings as well as classes. We refer to the second as a political organizational approach to stress that there is not only a "head" unit or leadership involved but also such structures as cybernetic centers, organizational hierarchies, and communication networks as, for instance, those

provided by modern political parties. Here, we draw on both the stratification and the political approaches and attempt to outline an analytic approach that combines them. In the following discussion, assets represent the distributive, stratification aspect and power the processual, political aspect. Assets represent latent energy; power refers to what is made out of the assets in the energizing of societal action. The two are closely linked both because the stratification structure sets limits, however broad, on the political organization and on societal action, and because the political organization and societal action have significant "feedback" effects on the structure of societal stratification.

Assets, Power, and Activation

An exploration of the complicated relations between the assets an actor commands and the power he wields is central for an understanding of the active orientation, because the capacity to act is greatly affected by the possessions of an actor *and* by what he does with these possessions. The common-sense view (and that of some political scientists) tends to estimate the power of an actor by an inventory of his assets. Nations with a large territory, a large population, high production of steel, oil, ship tonnage, or railroad miles are viewed as strong nations.[24] Or, among sub-societies, the rich are viewed as powerful and the poor as weak.

Actually, the amount of assets an actor has determines only the collectivistic context of his power, his power *potential* or base—that is, the amount of assets on which he can draw to support his action. The proportion of these assets he actually uses to generate power is a different, more organizational, more voluntaristic aspect of societal relations. Each actor constantly chooses, although often not consciously, how many of the assets he controls should be *consumed* (used to satisfy immediate needs), *preserved* for later consumption, *invested* to increase his assets, and *converted* into societal power.* Assets are, thus, a relatively "stable" (or structural) aspect of societal relations, while power is more dynamic (or processual).

The relation of power to assets is analogous to the relation of energy to material. The conversion of assets into power is not an abrupt "jump" but rather a process of transformation. Various steps may be taken to activate the assets and bring them closer to a power-yielding state without actually releasing the energy. Such activation occurs, for instance, when a collectivity

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* It is essential not to change the time perspective when making assessments of the allocative pattern of a societal unit, as, for instance, consuming resources now may make the actor more powerful later (e.g., by enhancing the morale of the troops), or converting some assets into power now may increase the actor's ability to consume later. But an asset (or part of one) that is used for one purpose cannot be used *at one and the same time* for another. Assets remain potentially universal instruments so long as they are not used; when used, they become particularized.

or society is preparing for a conflict—whether it be a war, a strike, or a period of demonstrations. These preparations are modern analogies to the primitives' war dances. Again, as in thermodynamics or electronics, while societal assets or power potentials may be accumulated and stored or activated in anticipation of future use, there are some costs or "losses" involved since some of the potential energy is "dissipated" and increasingly so as time passes. Thus, arms or means of production grow obsolescent, and morale and leadership not actively engaged tend gradually to erode.*

Conversion Ratios and Patterns

The power of an actor is determined by an interplay between his controlling overlayer and his assets. On the one hand, his controlling overlayer greatly determines the degree to which he consumes his assets, accumulates assets, commits his assets to a specific course of action, and so forth. On the other hand, whatever the nature of the controlling overlayer, an actor's power is also affected by the asset base upon which he can draw. Obviously, if the base is narrow, the utmost curtailment of consumption and the highest commitment of assets to the generation of power may provide less power than a much smaller effort on the part of a more affluent actor; optimal control can substitute for affluence only to a degree. In addition, there is a declining marginal utility for both factors in the sense that once control is fairly effective, a small gain in assets will have a considerable effect while additional control improvements will have comparatively little effect. At the same time, additional resources will afford little gain to the fumbling affluent actor, while a relatively small improvement in his guidance mechanism may increase his action capacity considerably.

While both factors are operative, it seems that *in the short-run, the capacity to improve control is higher than the capacity to increase assets.* In crisis situations, for instance, many actors unveil "hidden" power; that is, they overcome resistance which previously they were believed unable to overcome, not because the societal unit suddenly possesses new assets but because the control of the assets is shifted from sub-societal to societal usages and from

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* There is a difference here between the world of objects and societal processes, and it is here that a voluntaristic element is particularly evident: The continued accumulation of energy tends to generate high tension and a pressure to act. However, to respond to such a pressure is frequently not rational from any viewpoint other than the instrumental considerations of power storage. Hence, the controlling overlayers of an active unit require special provisions to deal with such pressures. This is achieved by the institutional and organizational segregation of the societal decision-making units from the organizational units in charge of societal power storage (especially of the coercive kind) and by a consciousness, preferably on the part of both elites and publics, of the need to contain these pressures. Otherwise, they become a major source of distortion of societal guidance mechanisms by mistriggering and pretriggering them and being generally hyperactive.

societal consumption to the generation of societal power. To the degree that such crises simply occur (i.e., are a result of processes in the environment or in the system), they are of limited interest for societal guidance. But many crises are produced by control centers or elites, frequently as part of their efforts to alter the allocation of assets in their societal units or to increase the proportion of assets converted into power.

In the long-run, the asset base itself, stratification, changes greatly and is to be conceived not merely as providing a base for generating societal power but also as reflecting the use to which such power has been put, for one of the major purposes toward which power can be applied is to gain possession of new assets. In comparing societal units from this viewpoint, differences in the conversion ratios and patterns are to be taken systematically into account. The conversion ratio specifies the proportion of an actor's assets which are used to generate power as compared to his total assets. The conversion pattern is the distribution of those assets earmarked to power usage among various kinds of utilization. A conversion pattern, for instance, may be narrow or broad in scope, encompass mainly external or also internal areas, and so on.

What are the historical trends with regard to the conversion ratios and patterns of societies? It at first seems that an increasingly higher ratio of assets is devoted to societal usages. But detailed statistical analysis is needed to establish whether, as the amount of assets possessed by the members of society has grown rapidly (as crudely indicated by the growth of the GNP), there has been a proportional increase in the amount of assets assigned to societal usages (roughly represented by the public expenditures of both governmental and non-governmental agencies), or whether the increase in the absolute expenditure (which has obviously occurred in the post-modern as compared to the late modern period) has been accompanied by a decline in this ratio.[25]

Regarding the conversion pattern, the extent of the discussions about the welfare state or welfare capitalism would lead to the expectation of an historical trend toward an increasingly internally-focused pattern. But the semi-war state which has existed in many societies since the advent of the post-modern period suggests that, if we take the post-war years as our base, defense expenditures have risen even more than domestic ones.[26]

The only trend which seems to be in accord with the common sense expectation is the breadth of societal control: More sectors of societal activity are guided collectively in the post-modern than in the modern period, though the main pattern had been established in the last modern century (1845–1945).

Bringing about an active society will require the assignment of a greater amount *and* ratio of societal assets to societal usages, since the realization of goals served collectively seems to lag behind the realization of those served directly by sub-units or by their unguided interaction. Similarly, more effort

will be needed for internal than for external areas. Contemporary societies which are more active in other respects also have a more internally-oriented pattern. The scope of the sectors encompassed by collective guidance would

Country	*GNP*	*Defense*	*Per cent*	*Education*	*Per cent*	*Health*	*Per cent*
United States	628,700	51,323	8.2	30,400	4.8	10,000	1.6
Denmark	8,940	255	2.9	300	3.4	190	2.1
Norway	6,200	220	3.5	325	5.2	100	1.6
Sweden	17,200	826	4.8	800	4.7	400	2.3

Figures are in millions of United States dollars equivalents for 1964, and provided by Sprecher, *op. cit.*, pp. 7 and 8.

be expected to vary least because it is already quite broad.[27] The societal guidance of technology has been only initiated; the societal guidance of other areas—such as the reallocation of wealth and the restructuring of status-relations—has already begun, but it has not been sufficiently "energized," as judged by the actors' own goals. The most neglected area seems to be the development of societal guidance mechanisms, especially within the higher echelons of society-wide decision-making units, knowledge-units, and units devoted to the critical function.

In the conversion of assets into power, much of the potential energy is almost invariably lost, as when energy converted into light is wasted on generating heat. The higher the *quality* of a conversion process, the more societal energy is released. This is a question of the extent to which the conversion is well organized and politically responsive. For instance, the same amount of taxation will yield varying degrees of financing of societal action depending on the mode of taxation that is used. (Taxes vary significantly in terms of their administrative and psychological costs. Compare, for instance, sales taxes to income taxes and both kinds of taxes as collected in the United States to tax farming in ancient bureaucracies.) Other differences in mobilization and in cost result from the relative reliance on central as against local government agencies and on government as opposed to public authorities, such as the BBC or the Port of New York Authority. The higher the over-all quality of an actor's conversion processes, the more power he can derive from the same amount of assets—that is, the more societal action can be energized without an increase in the asset base and without additional commitment or mobilization of the actor's assets.

The dimensions of conversion—ratio, pattern, and quality—used in combination characterize a major aspect of the morphology of society. The term "societal character" is appropriate when the dimensions of conversion are largely set and are treated by the society as basically given. "Social character" is a collectivistic concept, used mainly by anthropologists and sociologists.[28] Another related term, used by political scientists, is "national

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style."[29] For instance, to say that a society or culture is "aggressive" often implies that the conversion ratio is high, its pattern is externally focused, its quality is poor, and, above all, it is unchangeable. Modern, post-modern to a greater extent, and, above all, active societies view the conversion of assets into societal power as changeable in accord with societal policy. It is considered possible to increase the ratio (or modify it upward and downward); to shift the investments (though mobilization for external usages still seems much easier than for internal ones, which limits the capacity to shift societal energy from exerting power over other factors toward self-transformation); and to find and implement more effective conversion methods (e.g., ways of selecting men for public office).

For relatively active societal units, the term "strategy" is appropriate, since these units deliberately decide the amount of the assets to be converted and in what way.[30] Strategy for economic mobilization is a case in point. While even these actors are not free to set their conversion ratios and processes as they wish (they, too, are subject to internal and environmental pressures), they are relatively aware of their capacity to reset the conversion ratio and pattern and, thus, are relatively voluntaristic and active.

It should be noted that while conversion is part of the societal guidance mechanism, it is affected by the values and the distribution of assets in the body of the societal unit or underlayer. However, these values and assets, in turn, are affected by the conversion processes. Thus, at each point in time, conversion, the societal asset structure, and the system of values should be taken as three independent variables and their relations to each other should be studied over time.

Power, Deviation, and Transformation

Societal structures, it is sometimes disregarded, are not composed only of internalized expectations, role-constellations, and institutionalized symbols and values.[31] All societies exhibit patterns of the distribution of assets.[32] While the patterns vary in different societies, they are always a-symmetrical in that some collectivities have a larger share of the assets than others.[33] While these assets include some symbolic ones (such as prestige) and while the patterns have symbolic aspects (e.g., some are viewed as more legitimate than others), relative access to assets has a "mechanical," objective base. Actors who command more assets, especially of the economic and coercive kinds, have more options to consume, save, invest, or generate power than other actors, irrespective of whether or not the actors are aware of the fact, legitimate it, or approve of it. Moreover, while the symbolic aspects of societal processes do affect the distributive patterns of assets, these, in turn, affect the symbolic aspects. The differences in prestige of such titles as lord or king when they commanded many utilitarian and coercive assets as opposed to their contemporary status illustrate this observation.

The neglect of the non-symbolic aspects of the societal structure and organization of power is particularly visible in much of the work on deviant behavior and its role as a source of societal transformation. In this section, we digress briefly to explore deviance from this viewpoint. Incomplete or distorted socialization, the successful internalization of deviant norms or of two or more sets of conflicting norms, or insufficient symbolic rewards by various mechanisms of social control have often been emphasized as the sources of deviant behavior.* While all of these factors, which rely considerably on symbolic processes, are significant, it is often not systematically taken into account that actors in many roles and situations, in order to conform, require, in addition to the motivation to do so and knowledge of the "proper" paths to follow, the appropriate means. If the societal distribution of assets fails to provide these means (or the bases from which they can be mobilized) to one or another societal grouping, this failure alone will tend to produce large-scale deviance,[34] both because the lack of available means is frustrating to those successfully socialized to the conforming norms and because the roles simply cannot be fulfilled without the means. When Pharaoh wanted the Jews in ancient Egypt to "deviate" so that he would have a pretext for punishing them, he demanded that they produce more bricks even though he provided them with less straw.[35]

In addition to the lack of assets needed to conform, a lack of assets allocated to control plays a major role in determining the scope of societal deviance and its macroscopic consequences. Once a deviant enclave has been founded, its future development and the chances that it will become a major societal force,[36] a transforming alternative, or perhaps even the basis of a new societal conformity, depend not only on the numbers of unsuccessfully socialized people or on the extent to which the society's "educational" efforts are encompassing and intensive but also on the distribution of the means between the societal units mobilized in support of the prevailing patterns and those which are deviating. Revolutions occur not so much because the deviant asset base in itself has been greatly extended but because the asset base of the supporters of the conforming patterns is collapsing. The weakness of the governments of Russia in 1917, China in 1949, and France in 1789 was a "final" cause of the transformations of these societies. The same seems to hold for less dramatic changes from one societal structure to another—e.g., the British transformation from an aristocratic to a bourgeois conformity.

The relations between the stratification structure and political organization of a society and the extent and intensity of deviation are twofold. On the one hand, the macroscopic outcome of the struggle between conforming and

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* Most of the theories and studies reviewed in the encompassing essay by Albert K. Cohen fall in this category. See his *Deviance and Control* (Englewood Cliffs, N.J.: Prentice-Hall, 1966).

deviating forces depends on the asset bases of these forces and the quality of their power-generating mechanisms. In 1917, the Tsarist government's asset base, weakened by the war and economic anarchy, rapidly declined in its capacity to mobilize power, while the Bolshevik movement was much better able to mobilize its asset base and to focus its efforts. On the other hand, changes in relations between the conformers and the deviators register in changes in assets and power bases. One main result of the rise of a new societal alternative is a redefinition of the societal structure. A societal structure is, thus, to be viewed not as a given pattern of a system, but as a temporary form reflecting the past actions of conforming and deviating member-units and internal and external elites, and as a base line for future interaction among these actors within the environmental limits.[37] Societal structures are expected to be continually restructured or transformed; it is an exception rather than the rule when the relations among the units, supra-units, and elites are so balanced as to cause a forward and backward "swinging" of a pattern as if it were the focal point of a stable equilibrium. This concept of structure assumes that *the extent and intensity of deviance will be greater, the less the patterns of the distributive structure and the political organization parallel the patterns prescribed by the symbolic-normative system.* Moreover, even when this parallelism is maximal, a built-in strain is to be expected; differences between the symbolic-normative and asset facets of society are never completely resolved because the symbolic-normative systems tend to be relatively more integrated than the asset bases. This is the case because societal assets must provide for a multitude of partially incompatible functions, and because non-symbolic elements are more scarce than symbols. Additional societal strains are generated by differences in the distributive patterns of the various kinds of assets which create stratification imbalances.

Several concepts which are used later derive from this discussion and should be mentioned here. *Lower* and *higher collectivities* refer to their respective shares in the existing societal patterns of allocation. Higher collectivities have *vested interests* in existing structures, lower—in their change, whether or not their political action shows awareness of this. *Unbalanced collectivities* are high in some assets and low in others; the nature of their vested interests, as we shall see, depends on the specific nature of the imbalance.

Societal strains are collective experiences in that they are shared by large categories of members. The categories provide an objective base on which various associational and organizational processes operate to collectivize and mobilize shared experiences into political action attempting to change the societal structure, to reduce the strains for one collectivity or another, or to improve the "fit" between the symbolic-normative and asset-power aspects of the society. Hence, pressures toward change are built into the societal structure, and they are expected to be greater, the more complex the societal

division of labor and the more widely distributed the associational, organizational, and mobilizing capacities among the members become.

It is, therefore, a "limit" situation when the society is integrated to such a degree that there is one dominant pattern of conformity in terms of which deviation can be simply defined. Aside from situations in which there is no prevailing pattern, there are many other situations in which, even though there is a prevailing pattern, other patterns have the status of what we refer to as *secondary alternatives*. Members who hold these secondary alternatives are tolerated and defined as conforming but are not considered in the "main stream." These patterns stand next to *semi-deviant* and *full deviant* ones.* The relative status of the various patterns continually changes; while there are a few "jumps" from full deviance to central conformity, smaller changes—from full to semi-deviance or from a secondary to a primary alternative—are more common. The accumulation of smaller changes may lead to the transformation from a full deviance to a central conformity pattern. At each point in time, however, rather than a conforming pattern and deviations from it, there are a variety of alternatives struggling over their relative status, with *the outcome of the struggle being greatly affected by the relative power mobilized by the various alternatives.*

It is necessary here to distinguish political from other deviant behavior. One of the major insights of social science was that common sociological and psychological attributes underlie such seemingly different deviant behaviors as alcoholism, extremist political activity, crime, and psychosomatic illness. But to label all these behaviors "deviant" conceals the fact that some deviant behaviors are *much* more likely to provide societal alternatives than others because they are able to evolve an alternative societal design and mobilize power to promote it. Non-political deviants tend to be "microscopic"; they exhibit personal, interpersonal, or, at most, subcollectivity deviant behavior. Their deviations also tend to be narrow in scope; while deviating on some aspects, they may well conform on many others.[38] Above all, they usually do not promote an alternative design of society. Even when they are innovative,[39] their innovations tend to be limited to a freedom to choose among more sexual alternatives or to use drugs as a new escapist means. Political deviants are, first of all, usually of the innovative type, and their innovations tend to be broad in scope and macroscopic at least in intent and design, if not in consequence. They *may* provide the base of a new society (or the restoration of a fundamentally different "old" one), which cannot be said about the other types of deviants.

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* This distinction is closely related to the difference between functional alternatives and functional equivalents. The above observations suggest that functional alternatives tend not to be functional equivalents, and one issue around which the difference can be expressed is the relative degree of deviation (or conformity) involved.

The degree to which the new designs are implemented is, again, to a large extent a question of the relative power of the deviant and conforming forces, with the outcome of the struggle often being a partial legitimation of the deviant alternative *or* a partial transformation of the prevailing conformity, and not necessarily complete suppression *or* full transformation. Changing the secondary alternatives, weakening the main one, and so on, are equally plausible and possibly much more common. While it is true that in some exceptional cases, non-political deviants will also form a macroscopic organization and collectivity—e.g., some sectarian religious movements or a nationally-organized crime syndicate which draws on an ethnic sub-collectivity—they still tend either to be narrow in scope seeking to neutralize or alter only a few aspects of societal control, rather than to engage in power mobilization and political action to change society at large (that is, become political innovators). Thus, the Mormons in their polygamist period were *religious deviants*; the New Left are macroscopic, *political innovators*. The Mafia is a *deviant* criminal organization; the Students for Democratic Society are macroscopic, *political innovators*. While for some purposes it may be useful to treat them all as deviants, for the student of societal change and guidance it is not.

The level of deviance and the societal pressure toward transformation are affected, we saw, by the relation between the symbolic–normative and asset–power facets of society. But, as the distributive patterns of assets and those of political organization are themselves not necessarily parallel, the degree to which they are articulated also affects the scope, frequency, and direction of deviance in general and political deviance in particular. The degree to which the stratification and political patterns of a societal unit are articulated is affected by several factors which we encountered before but which ought to be mentioned here; basically, they characterize the societal unit under study in terms of the degree to which the societal overlayers and underlayers are coextensive.

Political and stratification patterns are expected to be more articulated: (a) the more the activity of the unit as a unit—as distinct from an aggregation of sub-units—is controlled by members rather than by external elites; (b) the more such internal control is dispersed among the members and the less it is concentrated in one or a few *member* units (this defines the distribution of power as elitist versus egalitarian); and (c) the more control is distributed among the members of a system as against concentrated in the system's elites.

In the realm of power, members of units differ in the various *kinds* of power they can employ. For most societies and collectivities, the resulting profiles of the distributions of the three kinds of power are expected to be more similar to than different from each other, regardless of whether the profiles themselves are elitist or egalitarian.[40] However, we can always expect some discrepancy.

The next question concerns the relations among different power elites (which head the various power organizations). One of the common forms these relations take is for one kind of power elite to dominate and determine, in detail or at least in a highly specified context, the position, function, and direction of the others' efforts; this is the totalitarian pattern, with the Party or the Army constituting the dominant power elite and organization. In relatively pure pluralistic systems, which are approximated by some international systems, the relationship between the various kinds of power elites is more open, with no clear domination on the part of any elite and with a political elite acting as a broker among the various unit-elites. In less pure pluralistic systems, the political elite has a directive (though usually only broadly contextuating) as well as a mediating function. Other combinations, of course, are possible. Whatever they are and, more generally, whatever the various power profiles, the ways in which they are related to each other and to the societal underlayer and the way in which they change affect the capacity of the societal unit to marshal its energy for the promotion of its goals. That is, the internal power structure is a significant determinant of the external and internal uses of societal power, and the dimensions of this structure, briefly reviewed here, must be included in any theory of societal guidance and macro-sociology.

Exchange, Power, and Structure

The concept of power does not play so central a role in collectivisitic theories as it does in a theory of societal guidance.[41] One reason for this is that in the collectivistic perspective, system bonds are viewed as semi-organic, and, hence, there is no analytic place for a unit with a capacity to fundamentally restructure the system; as the scope of permissible societal action is limited, so is that of power. Collectivistic theories do not, so to speak, "need" the concept as much as a theory of societal guidance. Moreover, collectivists tend to view the system bonds as primarily based on shared values, institutionalized symbols, collective sentiments, or converging interests emanating from the division of labor; power is rarely viewed as a basis of integration. The same theories tend to explore the distributive patterns of assets from the viewpoint of their contributions to the existing system and the prevailing structure and not as a potential base for the mobilization of power for transformation; they tend not to view the existing political organization as one—temporary—expression of a larger set of options the asset base could carry. And the role of power in limiting the bonds of a system or in transforming them to become more encompassing is not explored.[42]

More recently, the system role of power was recognized by various theoreticians, especially in their attempts to integrate exchange analysis with system theories.[43] For instance, it has been suggested that system bonds

arise when sub-systems trade "legitimation of authority" for "moral responsibility for collective need" on the part of political elites.[44] The relationship is based on an exchange in that if one of the sides should not "deliver," the chain of reciprocity would be broken, and the relationship would be undermined. In further extending this approach, much may be gained by relating the exchange-in-a-system analysis to the study of stratification and political organization—i.e., to a morphological analysis.

Exchange, as we see it, is not random; it occurs within a structure, and the give-and-take are neatly balanced only in formal, technical terms and not in substantive or socio-political ones. Each societal unit has a power profile; that is, some of the members have greater effects on the course of the collective action than others. While this power profile is continually revised, at each point in time it affects not only the distribution of assets but also the rates of exchange—i.e., how many units of output must a collectivity or a society expend for each unit of input it obtains.[45] *These rates tend to be more favorable for a more affluent and powerful unit.* The rich in the United States, for example, can obtain credit at a much lower cost than the poor; women get paid less for the same work than men; the people of poor nations have to work more hours to obtain a unit of international exchange than those of rich ones—i.e., they have to work longer for the same inputs.

In short, exchange among equals is a "limit" situation; the terms of almost all exchanges are affected by the uneven power relations among the participants. To study the relationships among actors as if exchange were symmetrical (or balanced) is to conduct a faulty analysis and to be unaware of the normative implications of the extent to which power is used in exchange for unilateral advantage. The value of exchange analysis will be realized only if it is integrated into asset-power and morphological analysis.

Power and Communication

Power and communication are found in all societal relations: among member-units, between them and the supra-unit, and between the controlling overlayers and the action underlayers. Our prime concern is with the latter relationship; here, power and communication are the two main implementing factors which "transmit" the signals of the controlling centers to the performing units and carry their "feedbacks." Organizational networks and consensus-formation structures are, above all, institutionalized power and communication pathways. As these statements are certainly not universally accepted, we turn now to a brief discussion of the arguments raised by voluntarist and collectivist theoreticians in favor of a conception of societal guidance based on communication without the backing of power.[46]

Control Without Power?

There have been serious and repeated attempts in social and political science to do without the concept of power. It is not that the concept of power does not appear in the descriptive or *ad hoc* explanatory statements of those who attempt to avoid it, but that the concept is either explicitly excluded or simply omitted from the theoretical models used. For the most part, communication is stressed instead. The position is effectively telescoped in the following statement by Karl W. Deutsch, one of the most outstanding political scientists of this century. "Essentially, control involves the transmission of messages, and the understanding of control processes is a branch of communication engineering, not of power engineering."[47] Government is, accordingly, viewed as a communication network or a web of nerves. The network carries signals from various centers of control to the performing units and back from them to the control centers. Networks differ in the clarity of their signals, the degree of "noise" on the line, and the extent of the overloading of switchboards—all factors that affect the communication of the signals. But once appropriate signals reach the appropriate receiver and are clearly understood, they are expected to bring about the appropriate action, not by their power but by the change they produce in the actor's pattern of information. It is analogous to inserting the right key into the right keyhole; what is essential is not how much power is used to turn the key but that the appropriate key is inserted. The amount of resultant change is not relative to the power of the signal, which is often very weak, "much as the force of a gun shot need not be proportionate to the amount of pressure needed to set off the trigger."[48] Typically, communication and cybernetic systems are viewed as small energy redistributions which guide the work of large energy systems.[49]

In contrast, power analysis assumes that in order to act, power frequently has to be expended (to reduce resistance), and that the degree of action is greatly affected by the degree of the power mobilized and committed: Small expenditures of power can initiate only a little action unless resistance is low (which is rare when the scope of action is significant) or has already been overcome (which means that power analysis has to be applied to the previous situations). The analogy of the gun is cogent; while it is true that the power of the trigger is minute, this does not explain the power of the bullet to overcome the resistance of gravity and the friction of the air. The trigger is just a communication of a signal—"fire now!" The thrust of the bullet, however, is determined by the power that has been *previously* stored in the gun powder, which the trigger only releases.* If a government orders

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* A relatively minuscule amount of power is involved, typically, even here—the power which set into motion the process of transforming the gunpowder into gas But in comparison to the energy released, it is negligible.

its troops into a particular region, a communication analyst explains what happens when the signal does not reach the commander, when he does not understand it, or when he is receiving conflicting signals. But his action is not wholly shaped by the signal, although this may seem to be the case if the act is studied with a short time-perspective. It is in part determined by the commander's "assets" (e.g., the number of troops he commands) and by his ability to convert them into power (e.g., the extent to which the troops are loyal to him). Without his troops, the commander's ability to respond to the signal would be no greater than the ability of a bullet to fly if there were no gunpowder in its shell. And central to the commander's response to the signal is his conception of the power that will be applied to him by the signalling center if he fails to comply.

Of course, communication does affect action, and the various factors determining the flow of communication must be studied if the dynamics of societal action are to be understood. It is also a valuable insight that the amount of energy used in transmitting communication is low in proportion to its results (although the investment in establishing and maintaining communication channels as well as in producing the message—i.e., knowledge—is to be included and increases the costs). But such communication analysis must be combined with power analysis and cannot replace it. To understand the different behaviors of various actors, we need to know the powers they command *and* the effectiveness of their communication networks. The controlling overlayer consists not only of signals but commands some power of its own; thus, if unit x does not respond to a signal, the controlling overlayer can make it act in accord with the signal not only by sending a clearer signal along a line with less "noise," but by dispatching another unit to force (or threaten) the recalcitrant unit x. (The unit sent might be a performing unit like the recalcitrant one or be attached to the center itself.)

This holds not only for the military but for other societal units and organizations as well. For instance, when the American aluminum and copper industries did not respond in 1965 to President Johnson's "signals" to refrain from raising their prices, he ordered the selling of aluminum and copper from the government stockpiles. Had the government not possessed such stockpiles or had they been substantially smaller, the power relations between the administration and the industries would have been quite different. In any case, it was not a matter of the industries' reading of the President's signal; what was not clear to them at first was how much power he was willing to use to make them follow his communication.

Controlling actors continually have to make two kinds of decisions: what communicative signals to issue and what power to use to support them. As, we suggest, the *assets from which power is generated are much more scarce than the symbols which are the main base of communication*, controlling overlayers typically issue many more communication signals than they can

support by the use of power. Many of these signals do not require such support because they demand no action but, let us say, "emit" information. Furthermore, to the degree that an authentic consensus has been formed, communication will suffice. But if the signals are to control, they must be backed by a power potential. Actors can issue communication on power "credit," hoping not to have to cash it in, or "bluff"—communicate as if they had power when they do not.[50] But these are basically extrapolations and projections of the real power base; without it, the effect of controlling signals will decline and cannot be relied upon. Both bases of control have costs: Communication costs are incurred in getting the message from one unit to another; power incurs costs in making the recipient follow the message. The basic reason that students of communication have noted that the "transportation" of small energy can control the performance of high energy-consuming units is, we suggest, that the *higher* control costs under most circumstances are power costs, which they do not study.

To some degree, power and communication can be substituted for each other: If the message is less clear but more enforced or less enforced but more clear, similar results may be obtained. But such substitutions are limited in scope; when faced with resistance, the clearest communication will be useless unless it is backed with sufficient power, and a large application of power will yield little action if the control centers receive vague or conflicting information about what the performing units are doing and how the environment is changing. This may be illustrated by the relationship between military power and military intelligence, since in this context the relations between the two factors are particularly observable. If the "goal" is to rout an enemy from a sizeable jungle, extensive bombing will be of little use if no knowledge about the location of the enemy can be communicated to the pilots of the bombers. Similarly, full information and communication are to no avail if, because of weather conditions, the bombers cannot operate—i.e., both factors are needed for control. Within these limits, the more knowledge that is communicated, the fewer bombs that are necessary; and the less that is known, the more bombs that are needed for the same results.

Above all, *increasing both control elements offers the actors more options and, thus, the potential for more creative responses*, for a more active orientation. To illustrate: In a mid-western city, civil rights groups used to counter urban renewal drives which entailed destroying slums before adequate alternative housing was provided by lying in front of the bulldozers when they approached. This involved civil disobedience which is a "costly" operation. Over the years, the civil rights groups organized an "early warning" intelligence system to discover ahead of time which sites were designated by the city for urban renewal. This allowed the groups to protest in the press and to the legislature, to mobilize public support, to demonstrate, and still—if necessary—to block the bulldozers.

The same analytic issue appears in a context which is less macroscopic

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but of much interest to the theory of societal guidance—in the debate over the validity of the Human Relations approach to the study of industrial relations. The Human Relations approach has a variety of representatives and a development of its own, but all of its original advocates almost completely ignored power analysis.[51] The emphasis was typically on leadership *style*: Leadership that was more understanding, communicative, and sensitive to the subjects' needs was believed to be more effective in attaining high productivity, compliance, and morale. The underlying assumption was that the workers had identifiable psychological needs, such as those for affection and direction, which could no longer be satisfied outside of the corporations because of the disintegration of the societal fabric inherent in the industrial revolution.[52] If the industrial elites were to respond to these psychological needs by providing positive and authoritative leadership and communications, they could command the workers' efforts and loyalties. Such satisfaction of the workers' psychological needs, it was at least implied, could obviate increases in wages and unionization and the ensuing power struggle. Critics of the Human Relations School saw a degree of power struggle, conflict, and tension between workers and management as inevitable and not necessarily dysfunctional; differences in styles of leadership and communication were viewed as having comparatively little effect.[53]

Actually, it seems that when workers belong to unions which effectively express their sentiments and interests and when they are well paid, communication between workers and management plays a relatively important role; when the conflict between workers and management is latent and uninstitutionalized, either because unions have not been allowed or because they have been rendered ineffective, and when workers are underpaid, the effect of communication differences is small. Thus, again, power and communication analyses complement each other rather than one making the other superfluous.

Above and beyond the specific Human Relations writings, in general an emphasis on *leadership* tends to be associated with an emphasis on the manipulation of symbols and communication, while discussions of elites tend to be more oriented toward an analysis of power which includes non-symbolic ways of overcoming resistance as well as symbolic manipulations. While there is no one-to-one association between the use of these terms and an analytic position, the term used often provides an early indication of the author's position. (The use of "class" is similar to "elite" in this context, except that economic power is stressed more than military or political power.)

When two theoretical conceptions conflict, it is occasionally suggested that two parallel theories be developed and used alternately or that they be merged later. This has been suggested for the beam versus wave theories of light and for the integration versus conflict theories of social systems. But this procedure would be particularly harmful to macro-sociology if separate

communication and power theories continue to be evolved, since several key issues require drawing on both conceptions and systematically articulating them. For example, controlling overlayers seem to differ significantly according to the degree to which power and communication networks are parallel and mutually supportive or their respective centers are segregated and in conflict. When the two networks are fairly well articulated, which of the two has priority affects the functioning of the controlling overlayer. The stronger the communication element in a control mix, the more the controlling overlayer approximates a pluralistic system in which actors synchronize their activities mainly voluntarily; where the power element is stronger, the controlling overlayer approximates a central administrative system in which synchronization tends to be higher but also less voluntary.* There are many additional ramifications for societal guidance of the various combinations of communication and power networks; our purpose here is not to ennumerate them but to highlight the need to explore these two major elements of guidance in one theoretical framework.

The Poker Face of Power

Once the fact that communication is only one component of control is accepted, the next question becomes the ways in which communication and power relate to and affect each other. We have already seen that the power actors wield is determined not only by the amounts and kinds of assets they command but also by the proportion of assets they convert into power and the effectiveness with which they convert and use them. A main factor here is the communication capacities and skills of the actors; this is so because the uses to which assets can be put (their power potential) are difficult to assess which, in turn, causes a permanent gap between the symbolic and objective facets of power and allows the actor the opportunity to magnify the impact of his power by skillful communications.

Actors use their power potential combined with various placings of messages in much the same way that poker players use their cards *and* their gestures; the effective player gains more from his cards than his hand actually "allows," and the poor player often loses even when he has a superior hand. Gestures, symbolic acts, play a central role in magnifying or deflating the impact of a hand. This does not mean that the gestures players make are unrelated to the "objective base"; he who regularly bluffs with poor cards will sooner or later lose his shirt. Thus, some degree of *credibility* in the relations between communication and power has to be maintained or the

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* The "mix" defines the communication capacities and power available to *the controlling center*. If more power were available to *the member units* than to the control center, the opposite would hold unless consensus-formation structures substituted for the lack of central control. We return to this point below.

gestures become powerless. The maintenance of credibility itself, though, is in part affected by the players' communication strategies and not only by their assets. To explore this point further, in the balance of this section we concentrate on the poker face of power—i.e., on what actors are able to do with their assets, holding constant the amounts they control and the proportion of those they convert into power.

The macroscopic parallels of the poker players' gestures are *threats and promises* by societal actors, indications of intentions to withdraw or to grant support.[54] While these are related to the actual capacity to do so, the relationship is loose and the system of threats and promises has a set of norms, dynamics, and independent effects of its own. In the realm of economics, such a relationship exists between money and goods and services; in the realm of force—between threats to force (and promises to defend) and actual forcing; and in the realm of prestige—between the generalized status of a person and specific status-symbols.* In each of the three realms, there is no one-to-one relationship between symbols and assets. Governments often increase the money in circulation without a parallel increase in goods and services. They may threaten more without increasing their military forces. Thus, societal actors can promise and threaten more than they could afford to do if all the commitments had to be met at the same time and full cashing of the face value of the "notes" was demanded.

Second, while a degree of "bluffing" is a common strategy, the power of actors is affected by their reputation, which, in turn, is affected by how often they have been "called" and not "come through." In a monetary system, the value of the monetary unit declines as the number of units vis-à-vis the available goods and services is increased (inflation), and as the government reduces its rate of exchange for foreign currency (devaluation). Governments which devaluate often or allow prices to rise freely and rapidly lose the confidence of the users of the currency and, hence, the currency's action effect. In terms of prestige, the more symbols that are issued (e.g., titles of nobility), the less significant their consequences for action in terms of the respect they command and the smaller the efforts people are subsequently willing to make in order to gain them. In political relations, a labor union which promises to raise a given amount of campaign funds or to mobilize

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* Prestige itself, unlike economic assets and force, is a standing in the minds of people and, in this sense, is symbolic. But, as it is a general standing in the minds of many people (a sub-society or society), it needs specific signs (status symbols) to communicate the standing of a person or collectivity. As in other relationships between symbols and assets, the relationship between these specific signs of prestige and prestige itself is loose in that some signs can be awarded or produced without having the prestige base, though if this is widely done, there is an "inflation" of the sign and it gradually loses its value. That is, status symbols need to be "cashable" in order to maintain their credibility. For a brilliant analysis of the prestige base, see Erving Goffman, "Symbols of Class Status," *British Journal of Sociology*, Vol. 2 (1951), pp. 294–304.

volunteers and voters but realizes only part of these promises will find it more difficult the next time to gain the legislation it favors or to block that which it opposes.

Third, in each of these cases, a change in the circulation of the symbols has some independent allocative effect of its own. The inflationary printing of money reduces the buying power of the government as well as of everyone else, but, meanwhile, it shifts some assets from non-government to government hands. Similarly, the diluting of prestige symbols is only gradually noticed, and, meanwhile, the symbols continue to buy support, favor, funds, or whatever else for which they are traded. The labor union which later will not be able fully to cash its political promissory notes may by then have won a major piece of legislation. And a declaration of support from the spokesmen of n collectivities may evoke a declaration of support from a wavering $n+1$, a declaration it might find difficult to reverse even if the other collectivities do not maintain theirs; even more likely, its declaration and others like it will either make "cashing" unnecessary or will transform the empty promises of the initial declarations into actual commitments.

Fourth, factors other than "cashing" determine the *credibility* of threats and promises. One is the conduct of other actors, as credibility is a relative virtue. For instance, the low credibility of a labor union might still be more reliable than the promises of most of the other actors and, hence, the union will continue to be effective. Another factor is the prevailing norms of the system. Domestic politics in Britain, for instance, seem to exhibit a much lower tolerance of a lack of *political solvency* than, let us say, politics in Greece. And in power plays, as in economic credit, the larger the total amount of assets of an actor, the easier it is for his temporary lapses to go unpunished and to be forgiven.

All of this is possible because neither promises nor threats nor what, in effect, is "delivered" can be measured with any degree of precision. Hence, actors' reputations for power credibility and solvency are, in themselves, open to manipulation. But ultimately, especially in showdowns, credibility has to be maintained or power is lost.

Several theoreticians addressing themselves to the similarities between economic and political dynamics did not take fully into account the importance of maintaining credibility and the difference between the symbolic face and objective base of power. Power is characterized as a "generalized symbolic medium"[55] which is to the polity what money is to the economy. And "it became increasingly clear that money was essentially a 'symbolic' phenomenon and hence that its analysis required a frame of reference closer to that of linguistics than of technology."[56] Elsewhere, Parsons has argued that "language is perhaps the prototype. . . . Thus, a sign, 'Beware the dog,' may induce caution without the passer-by's actually seeing or hearing a dog."[57] While this is a valid observation, it seems incomplete without noting the relationship between such signs and real, barking and biting, dogs.

If there were no dogs behind the signs, the signs would soon lose their effect. The same holds for power: The relationship of threats or promises to the assets available for power purposes is like the relationship of money to the assets available for exchange; that is, while not every threat is "called" and while not every threat that is called must be "cashed," the action effect of threats is greatly affected by the frequency with which they are "cashed." Those that are not cashed at all have the same power as money that does not buy goods and services.*

A subsidiary point ought to be raised here. *Occasional* actual escalation of the degree to which threats are realized, whatever their initial intention, is not accidental but is inherent in the power-threat system; the more often that threats are not cashed, the lower the credibility tends to be, and the higher the gains that may be made by an occasional actualization. Thus, every use of a threat means that the pressure to actualize is mounting, as the stock of credibility is depleted.[58] Consequently, effective systems are not those that never actualize threats but those that have to actualize them less often than others. Contrast this with the view (advanced by Neustadt in his study of the Presidency and the federal use of force)[59] that any use of force is a sign of the failure of the system. As we see it, if Eisenhower had not sent federal troops to Little Rock, the federal government's capacity to achieve compliance with the Supreme Court's 1954 desegregation ruling and the 1964 Civil Rights Bill would have been seriously curtailed. In situations in which the actual use of force is to be avoided at any cost, it is necessary not to mount the first steps of the escalator. (This is, in essence, the position of those who favor complete disarmament.) Earlier balance-of-power systems typically allowed for an occasional war to restore the system by punishing but not annihilating actors that violated the rules of the game. That is, an occasional actualization of threats was part of the system. Most societal and inter-societal systems can still tolerate such an occasional "cashing in" of threats; but for a rising sub-set of international systems this use of the symbolic aspect of power entail great risks and, in this sense, is intolerable.

There are, thus, three different kinds of costs involved in the application of power: of the assets "consumed" as power is generated; of the power itself as it is spent; and of symbolic gestures which, the more often they are used, tends to bring closer the point of actual expenditure. The last may be viewed as a kind of credit established by the previous actual exercise of power. When gestures are made, the "credit" needs to be replenished or their effect is lost; thus, each gesture has a cost.

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* In other places in the two presentations, Parsons himself draws on these basic notions, but in his definition of power as analogous to money, he seems to disregard the functions of the asset base. This can be explained by his attempt to view power as influence and by his stress on the symbolic aspects of power—legitimation, loyalties, and moral responsibilities —over the mechanical elements of power which rest to a greater extent upon the asset base.

An awareness of these costs further supports the point stated above—that language is a questionable analogy for power, in that teaching more people a language and, in this sense, extending the symbols to others usually does not reduce their effect or value and often even extends them. On the other hand, symbols that have an asset base cannot be multiplied without some dilution of their power. Parsons stressed that power is not a zero-sum property, for in giving to one you need not take from others—the power of all can be increased.[60] While this is a valid observation, the problems of allocation are still relevant because the distribution of power at any point in time is an important factor in determining which actors will gain a disproportionate share of the new assets as these become available and, thus, increase their power potential. In short, the patterns of distribution and of the dynamics of redistribution must be considered together; we are not dealing with the allocation of a finite set of assets but rather with the reallocation of a changing total.

We have suggested that the concept of power can be defined without its being tautological, a hindsight, or untestable. Societal power is viewed here as the generalized capacity of a societal unit to overcome the resistance of other units, sub-units, or supra-units. It seems useful to view societal power as the energy derived from assets. The amount of power a societal unit generates is determined by its asset base, by the proportion of that base which is being converted into power (as compared to those assets "kept" or otherwise used), and by the quality of the conversion processes. The power a unit commands can be "stretched" by various communications, but communications not backed by power do not provide societal control. Power is an inevitable component of societal control, guidance, and activeness. At the same time, the exercise of power has a societal cost, a distorting effect which curtails activation. Power may assure that "things get done" but often may not insure that the resulting world will be responsive to those who live in it, including the power wielders! The varying combinations of the energizing and distorting aspects of societal power and their macroscopic consequences are the subjects of the next chapter.

NOTES

1. "In general, we understand by 'power' the chance of a man or of a number of men to realize their own will in a communal action even against the resistance of others who are participating in the action." H. H. Gerth and C. Wright Mills, *From Max Weber: Essays in Sociology* (New York: Oxford University Press, 1958), p. 180. Cf. other discussions of the definitions of power: J. R. P. French, "A Formal Theory of Social Power," *Psychological Review*, Vol. 63 (1956), pp. 181–184; John R. P. French, Jr. and Bertram Raven, "The Bases of Social Power," in Dorwin Cartwright and Alvin Zander (eds.), *Group Dynamics, Research and Theory* (New York: Harper & Row, 1960), pp. 607–623; Dorwin Cartwright (ed.), *Studies in*

Social Power (Ann Arbor, Mich.: University of Michigan, 1959); Robert Dahl, "The Concept of Power," *Behavioral Science*, Vol. 2 (1957), pp. 201–215; Herbert Goldhamer and Edward A. Shils, "Types of Power and Status," *The American Journal of Sociology*, Vol. 45 (1939), pp. 171–182; Edmund Dahlström, "Exchange, Influence and Power," *Acta Sociologica*, Vol. 9 (1966), pp. 237–284; Herbert C. Kelman, "Processes of Opinion Change," *Public Opinion Quarterly*, Vol. 25 (1961), pp. 57–78; Adolf Sternberger, *Grund und Abgrund der Macht* (Frankfurt: Insel-Verlag, 1962). James G. March, "The Power of Power," in David Easton (ed.), *Varieties of Political Theory* (Englewood Cliffs, N.J.: Prentice-Hall, 1966), pp. 39–70. Richard A. Schermerhorn, *Society and Power* (New York: Random House, 1961).

2. William T. R. Fox, "In Defense of Talking About Power," in his *The Super-Powers* (New York: Harcourt, Brace & World, 1944), esp. p. 10. Truman, *The Governmental Process*, *op. cit.*, pp. 189–190.

3. "Like all data of the real world it [power] defies rigorous definition," Friedrich, *Man and His Government*, *op. cit.*, p. 159. For references and review of the large literature on the subject of power, see *ibid.*, Ch. 9, and Dahrendorf, *Class and Class Conflict in Industrial Society*, *op. cit.*, pp. 166 ff. For a less precise, more literary treatment, see the second epilogue of Tolstoy's *War and Peace* (New York: Modern Library, n.d.), esp. p. 1115.

4. Nicholas John Spykman, *America's Strategy in World Politics* (New York: Harcourt, Brace & Company, 1942), p. 22. Coser makes this point cautiously: "However, it would seem that without actual exercise, only some types of power can be measured with any degree of accuracy. Possibly in the economic order. . . ." *The Functions of Social Conflict*, *op. cit.*, p. 135. See also on the inability to generalize power relations, Dean G. Pruitt, "National Power and International Responsiveness," *Background*, Vol. 7 (1964), pp. 167–168.

5. Which time unit, range of matters, etc., are chosen depends on the problem studied.

6. The notion of probability has already been included in the definition of power. See Weber, *The Theory of Social and Economic Organization*, *op. cit.*, p. 152.

7. Annette Baker Fox shows how Turkey, weak on most accounts and scales, extracted a number of concessions from powerful Germany in 1941. See her *The Power of Small States* (Chicago: University of Chicago Press, 1959), pp. 10–42.

8. On the scholars who rely relatively heavily on asset analysis, see below, footnote 24.

9. Actually, this holds even for relations between economic and religious statuses. See, for instance, Liston Pope, *Millhands and Preachers* (New Haven: Yale University Press, 1942), pp. 141–203.

10. For additional discussion of the operationality of the concept, see Herbert A. Simon, "Notes on the Observation and Measurement of Power," *Journal of Politics*, Vol. 15 (1953), pp. 500–516.

11. In a curious twist, John Kenneth Galbraith's powerful lament over the scarcity of resources available for public purposes, in contrast to the abundance of assets available for private consumption, became known as the "affluent society"—i.e., one that suffers from general abundance. *The Affluent Society* (Boston: Houghton Mifflin, 1958). See also David Riesman, *Abundance for What?* (Garden City, N.Y.: Doubleday, 1964), pp. 103–368.

12. Cf. Lawrence K. Frank, "Psychology and Social Order," in Lerner, *The Human Meaning . . . , op. cit.*, pp. 214–241, especially 239.

13. Ivar E. Berg, Jr. and David Rogers, "Former Blue Collerites in Small Business," in Arthur B. Shostak and William Gomberg, *Blue Collar World: Studies of the American Worker*, (Englewood Cliffs, N.J.: Prentice-Hall, 1964), pp. 550–566; David Rogers and Ivar E. Berg, Jr., "Occupation and Ideology: The Case of the Small Businessman," *Human Organization*, Vol. 20 (1961), pp. 103–111. Max Weber pointed out that one of the main conditions for the rise of free markets was the leveling of societal differences. Gerth and Mills, *From Max Weber, op. cit.*, p. 215. See also Max Weber, *The Religion of China*, translated and edited by H. H. Gerth (New York: Free Press, 1951), pp. 84–107.

14. Coser, *The Functions of Social Conflict, op. cit.*, pp. 132–137. Harold D. Lasswell, "Compromise," *Encyclopedia of the Social Sciences*, IV (1931), pp. 147–149. See also E. T. Hiller, *The Strike: A Study in Collective Action* (Chicago, Ill.: University of Chicago Press, 1928), pp. 192–206.

15. On this concept and the dynamics involved, see Chapter 15.

16. Each generation seems to have to reargue this point. Thus, twenty years after Hans Morgenthau's classical writings on the subject, as well as the works of Peter H. Odegard, Elva Allen Helms, and V. O. Key, the search for a powerless world, in which the law of morality prevails without the support of any power but that of the values themselves, has not been given up. See, for instance, *Speak Truth to Power* (Philadelphia: American Friends Service Committee, 1955) for the Quaker position. See also Norman Cousins' suggestion to establish a new international order by no more than the "force" of a free debate of ideas, *In Place of Folly* (New York: Harper & Row, 1961), pp. 120–141. On the suspicion of power, see David Easton, *The Political System: An Inquiry into the State of Political Science* (New York: Knopf, 1953), p. 116 and Inis L. Claude, Jr., *Swords Into Plowshares* (New York: Random House, 1956), Chs. 18 and 19.

17. Ronald V. Sampson, *The Psychology of Power* (New York: Pantheon Books, 1966), p. 32. This is also a central assumption of Robert Michels' "Iron Law" of Oligarchy. And see Harold Lasswell and Abraham Kaplan, *Power and Society* (New Haven, Conn.: Yale University Press, 1950), p. 240.

18. This point was made by Andrew Hacker, "Power to Do What?" in Irving Louis Horowitz (ed.), *The New Sociology* (New York: Oxford University Press, 1964), p. 136.

19. Neustadt, *Presidential Power, op. cit.*, pp. 1–57. See also Theodore C. Sorenson, "The Outer Limits of Presidential Decisions," in Joseph R. Fiszman, *The American Political Arena*, 2nd edition (Boston: Little, Brown, 1966), pp. 180–188.

20. Brzezinski and Huntington, *Political Power: U.S.A./U.S.S.R., op. cit.*, pp. 191–232.

21. ". . . In that frame of thinking, power in international politics is essentially superior force, active or latent, with international political relationships determined in the long run by who coerces whom, or is presumably capable of doing so. . . . No matter how the word *power* is formally redefined, most people seem likely to go on talking about power as if it were largely a function of violence." In Harold and Margaret Sprout, *The Ecological Perspective on Human Affairs: With Special Reference to International Politics* (Princeton: Princeton University Press, 1965),

pp. 20–21. See also M. A. Ash, "An Analysis of Power, with Special Reference to International Politics," in *World Politics*, Vol. 3 (1951), pp. 218 ff. "Coercive *influence*, which is sometimes called *power*," states Robert Dahl in his *Modern Political Analysis*, *op. cit.*, p. 50. Coercion and power are treated as synonyms throughout Chalmers A. Johnson, *Revolutionary Change* (Boston: Little Brown, 1966). See, for instance, pp. 17–18. Robert Bierstedt, "An Analysis of Social Power," *American Sociological Review*, Vol. 15 (1950), p. 731.

22. See Talcott Parsons, *The Social System* (New York: Free Press, 1951), p. 277.

23. Talcott Parsons criticizes C. Wright Mills for this association. "There is, second, the tendency to think of power as presumptively illegitimate; if people exercise considerable power, it must be because they have somehow usurped it where they had no right and they intend to use it to the detriment of others. This comes out most conspicuously in Mills' imputation of irresponsibility to his 'power elite' and the allegation, vaguely conceived and presented with very little evidence, that they are characterized by a 'higher immorality.' " *Structure and Process in Modern Societies* (New York: Free Press, 1960), p. 221. But a few years later, Parsons writes: "Money and influence may be conceived to operate as positive sanctions in the above sense. . . . The *negative* medium corresponding to money on the situational side is then power in the political sense." (Italics provided.) "On the Concept of Influence," *Public Opinion Quarterly*, Vol. 27 (1963), p. 44.

24. Stephen B. Jones, "The Power Inventory and National Strategy," *World Politics*, Vol. 6 (1954), pp. 421–452. Harold and Margaret Sprout, *Foundation of National Power* (Princeton, N.J.: Princeton University Press, 1945). More recently this position was advanced with much sophistication by A. F. K. Organski, *World Politics* (New York: Knopf, 1959), pp. 116–184, esp. 184. Cf. Blau, *Exchange and Power . . .*, *op. cit.*, pp. 116 ff.

25. Data relevant to the propositions advanced here will be found in Bruce M. Russett et al., *World Handbook of Political and Social Indicators* (New Haven, Conn.: Yale University Press, 1964); Bruce M. Russett, *Trends in World Politics* (New York: Macmillan, 1965); William M. Sprecher, *World-Wide Defense Expenditures and Selected Economic Data, 1964* (Washington, D.C.: United States Arms Control and Disarmament Agency, 1966). These works include the main references to other relevant sources. We expect to show that it supports the propositions advanced here in a future publication, to be devoted to testing of propositions. While the present one deals only with the advancement of propositions, we of course did not include propositions for which we found contradicting data.

26. Expenditures on defense are not all external, and some external expenditures are not defense items, but the defense expenditures provide a rough approximation for modernized societies.

27. It was atypically narrow in the United States, but the United States is catching up with expansion of the welfare state to be followed, we expect, by significantly more public guidance of education.

28. See, for example, Alex Inkeles and Daniel J. Levinson, "National Character: The Study of Modal Personality and Socio-cultural Systems," in Gardner Lindzey (ed.), *Handbook of Social Psychology* (Reading, Mass.: Addison-Wesley, 1954), p. 982.

29. Walt W. Rostow, "The National Style," in Elting E. Morison (ed.), *The American Style* (New York: Harper & Row, 1958), p. 247. For a discussion of the relations between the two concepts, see Daniel Bell, "National Character Revisited: A Proposal for Renegotiating the Concept," *Symposium of Personality*, to be published by Holt, Rinehart, & Winston, and Inkeles and Levinson, revised article (see Note 28), in the revised edition of the *Handbook of Social Psychology*, *op. cit.* (in press).

30. Stanley Hoffmann, "Restraint and Choices in American Foreign Policy," *Daedalus*, Vol. 91 (1962), pp. 680 ff.

31. "The structure of authority in science, *as it is in any institution*, is a symbolic structure." (Italics provided.) Duncan, summarizing Kenneth Burke, *Permanence and Change* (Los Altos, Calif.: Hermes Publications, 1954), in Duncan, *Communication and Social Order*, *op. cit.*, p. 130. See also Anthony Wallace, "The Psychic Unity of Human Groups," in Bert Kaplan (ed.), *Studying Personality Cross-Culturally* (New York: Harper & Row, 1961), pp. 129–163. Wolf, commenting on this approach, criticizes those which view "culture as a code for communication between individuals who must synchronize their separate and disparate lives." Such definitions, he says, are "literally ethereal." Wolf, *Anthropology*, *op. cit.*, p. 41.

32. Parsons discusses "reality factors" and adds, "But from the point of view of the central dynamics of the social system they are not the core of the problem. The core is to be found in the balance of forces which is involved in the building up and the counteraction of motivation to deviance, that is, of the alienative component of the need-disposition system." Parsons, *The Social System*, *op. cit.*, p. 278.

33. Harold Lasswell, *Politics: Who Gets What, When, How*, *op. cit.*, pp. 5–6, 9–14. Seymour M. Lipset and Reinhard Bendix, "Social Status and Social Structure: A Re-examination of Data and Interpretations, I," *British Journal of Sociology*, Vol. 2 (1951), pp. 150–168. Gerhard E. Lenski, *Power and Privilege: A Theory of Social Stratification* (New York: McGraw-Hill, 1966). On the relations between stratification and the polity, see, in addition to the preceding sources, the following: Raymond Aron, "Social Structure and the Ruling Class," *British Journal of Sociology*, Vol. 1 (1950), pp. 1–16, 126–143; Bottomore, *Elites and Society*, *op. cit.*, esp. pp. 18–41, and Lipset, *Political Man*, *op. cit.*, esp. Ch. II and Ch. VIII.

34. This point was made by Robert K. Merton's study of deviance under the concept of opportunity structure. *Social Theory and Social Structure* (New York: Free Press, 1957), pp. 145–146. See also Richard Cloward and Lloyd E. Ohlin, *Delinquency and Opportunity* (New York: Free Press, 1960), esp. 86–107; and Arthur L. Stinchcombe, *Rebellion in a High School* (Chicago: Quadrangle Books, 1964).

35. *Exodus*, 5:6–9.

36. On these conditions, see Ruth Leeds, "The Absorption of Protest," in W. W. Cooper, H. J. Leavitt, and M. W. Shelly II (eds.), *New Perspectives in Organization Research* (New York: Wiley & Sons, 1964), pp. 115–135.

37. For a similar view of structure, see Evon Z. Vogt, "On the Concepts of Structure and Process in Cultural Anthropology," *American Anthropologist*, N.S. 62 (1960), pp. 18–33, esp. 21. See also Walter Garrison Runciman, *Social Science and Political Theory* (Cambridge, England: Cambridge University Press, 1963), pp. 109–134.

38. Albert K. Cohen recognized that the delinquent was characterized by ambivalence in his book *Delinquent Boys: The Culture of Gangs* (New York: Free Press, 1955), pp. 136–138; Gresham M. Sykes and David Matza, "Techniques of Neutralization: A Theory of Delinquency," *American Sociological Review*, Vol. 22 (1957), pp. 664–670; David Matza, *Delinquency and Drift* (New York: Wiley & Sons, 1964), pp. 27, 36, 60–62, 101.

39. On the place of innovation in a typology of deviance, see Merton, *Social Theory and Social Structure*, *op. cit.*, pp. 141–149.

40. For empirical indicators, albeit in a micro unit, see L. S. Shapley and Martin Shubik, "A Method for Evaluating the Distribution of Power in a Committee System," *American Political Science Review*, Vol. 48 (1954), pp. 787–792.

41. On the role of power in collectivistic theories, see Talcott Parsons et al., *Toward a General Theory of Action*, *op. cit.*, p. 200. Roland Robertson, "The Analysis of Social and Political Systems," *British Journal of Sociology*, Vol. 16 (1965), pp. 256–257.

42. For discussion of this point in the context of a theory of societal guidance, see Chapter 20.

43. David Easton, *A Framework for Political Analysis* (Englewood Cliffs, N.J.: Prentice-Hall, 1965), pp. 119–124; Homans, *Social Behavior: Its Elementary Forms*, *op. cit.*, p. 78; Blau, *Exchange and Power . . .*, *op. cit.*, pp. 115–142.

44. Talcott Parsons, "On the Concept of Political Power," in Reinhard Bendix and Seymour M. Lipset (eds.), *Class, Status and Power* (New York: Free Press, 1966), 2nd edition, pp. 240–265.

45. On this concept and its sociological applications, see Etzioni, *Political Unification*, *op. cit.*, pp. 77, 315–317.

46. "Communication is the main process of *inter*action, by which processes of 'action' and behavior of units of the system are 'controlled.' " Parsons, *Structure and Process in Modern Societies*, *op. cit.*, p. 273. Parsons includes the concept of power but sees it as a mode of communication, as a language. Lasswell, discussing in detail the "act of decision," includes implementation, without a concept of power, in what has been referred to as "cybernetic ancestry of much recent thinking about the political process." The reference is by Richard R. Fagen, *Politics and Communication* (Boston: Little, Brown, 1966), p. 11. The work by Harold D. Lasswell referred to is *The Future of Political Science* (New York: Atherton Press, 1963), pp. 15–16. "According to cybernetics, society is a communication network for the transmitting, exchanging, and pooling of information, and it is this that holds it together. No emptier notion of society has ever been propounded." Hans Jonas, *The Phenomenon of Life* (New York: Harper & Row, 1966), p. 126. "Communication is the web of human society. . . . The flow of communication determines the direction and pace of dynamic social development." Lucian W. Pye, in the introduction to his edited *Communications and Political Development* (Princeton, N.J.: Princeton University Press, 1963), p. 4. See also p. 6. According to Kenneth Boulding, "an organization might almost be defined as a structure of roles tied together with lines of communication." Kenneth E. Boulding, *The Image, Knowledge in Life and Society* (Ann Arbor: University of Michigan Press, 1961), p. 27. Rieger, "The Mechanics of Bureaucracy . . . , " *op. cit.*, sees bureaucracy as an "information processing system" p. 176.

For a typical cybernetic statement, see Charles R. Dechert, "The Development of Cybernetics," *The American Behavioral Scientist*, Vol. VIII (June, 1965), esp. 19. See also Richard H. McCleery, *Policy Change in Prison Management* (East Lansing, Mich.: Government Research Bureau, Michigan State University, 1957); and Richard L. Meier, *A Communication Theory of Urban Growth* (Cambridge, Mass.: M.I.T. Press, 1962); H. A. Innis, *Empire and Communications* (Oxford, England: Clarendon Press, 1950). For another theory which focuses on transmission of the signals, lacking much of Deutsch's sophistication, see Thomas H. Crowley et al., *Modern Communications* (New York: Columbia University Press, 1962). See also Colin Cherry, *On Human Communication* (New York: Wiley & Sons, 1957), and Robert C. North, "Communication as an Approach to Politics," *The American Behavioral Scientist*, Volume X (April, 1967), pp. 12–23.

47. Deutsch, "Communication Theory and Political Integration," in Jacob and Toscano, *The Integration of Political Communities*, *op. cit.*, p. 49. See also his *Nationalism and Social Communication* (New York: Wiley & Sons, 1953), and especially his *The Nerves of Government*, *op. cit.* Deutsch's position on this matter is somewhat ambiguous. The following statement, taken from the jacket, represents the general tenor of his book:

> "The theory that government is more a problem of steering than of power politics provides the basis for this new analytical framework for political study. It represents a significant contemporary shift in emphasis from the study of 'muscles'—arms, manpower, money—to the study of 'nerves,' the channels of communication by which the exercise of power is controlled."

"Shift in emphasis" would imply full recognition of both sets of factors and a systematic attempt to relate the two. Actually, most of the book implies that nerves are important and muscles are not, and there is no systematic study of "muscles" and their relations to "nerves." On the other hand, Deutsch avoids an outright renunciation of power as an analytic tool.

"There are those who suggest that all of political science be reconceptualized in terms of communication, and of the factors which generate messages and determine their impact." (Reference is to Deutsch, *The Nerves of Government*.) Gabriel A. Almond and G. Bingham Powell, Jr., *Comparative Politics: A Developmental Approach* (Boston: Little, Brown, 1966), p. 165.

48. Deutsch, *Nerves of Government*, *op. cit.*, p. 146. See also pp. 82–84.

49. Charles Ackerman and Talcott Parsons, "The Concept of 'Social System' as a Theoretical Device," in Gordon J. Direnzo (ed.), *Concepts, Theory, and Explanation in the Behavioral Sciences* (New York: Random House, 1966), pp. 24–40, esp. pp. 31, 33. Aaron V. Cicourel, *Method and Measurement in Sociology* (New York: Free Press, 1964), pp. 149, 212–218.

50. For an example, see Wilson, *Negro Politics*, *op. cit.*, p. 111.

51. For one of the more sophisticated representatives, see William F. Whyte, "Human Relations—A Progress Report," *Harvard Business Review*, Vol. 34 (1956), pp. 125–132.

52. See Elton Mayo, *The Human Problems of an Industrial Civilization* (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1946), Ch. 8; and his *The Social Problems of an Industrial Civilization* (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1945), Chs. 1 and 6.

53. Reinhard Bendix and Lloyd H. Fisher, "The Perspectives of Elton Mayo," *Review of Economics and Statistics*, Vol. 31 (1949), pp. 312–319.

54. This subject has been the central attention of the work of Thomas Schelling. Schelling focuses almost exclusively on threats and avoids the subject of promises, as his main concern is conflict and not cooperation. Analytically, both have the same status and hence are treated here jointly. Thomas C. Schelling, *The Strategy of Conflict* (New York: Oxford University Press, 1963), esp. Part I. See also his *Arms and Influence* (New Haven, Conn.: Yale University Press, 1966).

55. Parsons, "On the Concept of Political Power," *op. cit.*, p. 261. Parsons turned to examination of power mainly after his main works were published. On the absence of power in Parsons' earlier work see David Lockwood, "Some Remarks on 'The Social System,'" *British Journal of Sociology*, Vol. 7 (1956), pp. 134–146.

56. Parsons, "On the Concept of Political Power," *op. cit.*, p. 258. See also Parsons, *Structure and Process in Modern Societies*, *op. cit.*, pp. 273–274.

57. Talcott Parsons, "On the Concept of Influence," *Public Opinion Quarterly*, Vol. 27 (1963), p. 38.

58. Nowhere is the fact that threats make systems of their own more evident than in the relations between nuclear powers, in which the balancing of threats and counter-threats is the basis of a strategic stalemate between the sides. The need to build up occasionally the credibility of these threats has been discussed effectively by Kenneth Boulding.

> "Such a system may be fairly stable for short periods. But it has a fatal instability. Its stability depends on the mutual credibility of the threats. . . . Credibility, as it were, is a commodity which depreciates with the mere passage of time . . . the time eventually comes when threats are no longer credible enough to keep the system stable. One party or the other decides that it believes so little in the threats of its potential opponent that it can defy them. When this happens the system experiences crisis. . . . The cyclic character of war is clearly a product of a system of deterrence which, as we have seen, will be stable for a while but will eventually break down into war."

See his *The Meaning of the Twentieth Century* (New York: Harper & Row, 1964), pp. 80–82.

59. Neustadt, *Presidential Power*, *op. cit.*, pp. 9–32, esp. 27–28.

60. *Structure and Process . . .*, *loc. cit.*, pp. 219–220.

3. In your testimony, you mentioned the need to evaluate forecasts and to establish a data base of historical forecasts and their accuracy. What institutions do you recommend for undertaking this task? Are there existing institutions in the Federal Government, particularly the Congress, that might assume this responsibility?

3. Several possibilities: the Office of Technology Assessment: Library of Congress; National Science Foundation (through contract); independent research centers.

4. You have stated that in most cases we cannot forecast with sufficient accuracy beyond 5 to 10 years. In many instances, however, it will take more than 10 years to achieve some long-range goals. Under this assumption, are forecasting capabilities futile because of some of our long-range objectives? Please explain your answer.

4. With some exceptions, it will be necessary to set nearer sub-goals, and deal with those; e.g. reduce poverty by half by 1980 via xyz, rather than by 100% by 1985, because so much unanticipated but relevant will happen meanwhile, etc.

5. What should be done to overcome the tendency to neglect forecasting in public policy analysis?

5. (a) Make forecasting more responsible, accountable, and useful. (b) Provide Congress with a greater standing analytic capacity, via a unit akin to OTA but not limited to technology. The question seems to assume it makes sense to segregate future-study from present-study. I am not quite sure this is advisable.

Good to work with you.

Sincerely,

Amitai Etzioni
Director

APPENDIX

SELECTED READINGS

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INTRODUCTION

Purpose of Readings

As a supplement to the information developed at the hearing and submitted for the record, a series of selected readings has been compiled, at the request of Senator Culver, for inclusion with this hearing record. These readings provide a useful introductory analysis and overview of the issues facing our society, and a more extensive analysis of the state-of-the-art and mechanisms of futures analysis and forecasting. Of particular interest is the section dealing with the foresight capability of the Federal Government. Hopefully this material will complement the information provided at the hearings, in enhancing the understanding of futures analysis and its potential for improving the capacity of society to respond to problems before they become full-fledged crises.

Preparation of Readings

The following readings have been assembled from a list prepared for the Panel on Environmental Science and Technology by the Congressional Research Service. An annotated biblography prepared by the Committee staff and the Congressional Research Service is included below.

In most cases the selections have been made from published sources, but in the case of the chapter by Wayne Boucher, a prepublication draft has been secured and is being included with the permission of the National Science Foundation.

Permission to reprint chapters or articles from the following books or publications is gratefully acknowledged to the respective publishers. C. Bezold, "Congress and the Future"; H. Kahn "Things Are Going Rather Well", J. Martino "But Haven't I Been Doing That All Along?", E. Cornish, "Think Small", E. Schumacher "We Must Make Things Smaller and Simpler" all published with permission of the World Future Society, Washington, D.C.; R. Heilbroner "An Inquiry Into the Human Prospect," and D. Schon "Beyond the Stable State," W. W. Norton & Co., Inc. N.Y.; "Changing Images of Man," Stanford Research Institute, California; and S. Enzer "The Role of Futures Research in Corporate Planning," Center for Futures Research, University of Southern California, Los Angeles; J. Coates, "Some Methods and Techniques for Comprehensive Impact Assessment," J. Martino, "Technological Forecasting For Decision-making," appears with the permission of American Elsevier Publishing Co., Inc. N.Y.; R. Amara, "Some Methods of Futures Research," Institute for the Future, Menlo Park, California; R. Zentner, "Scenarios in Forecasting," American Chemical Society, Easton, Pennsylvania; G. Hueckel, "A Historical Approach to Future Economic Growth," American Association for the Advancement of Science.

Readings on Emerging Issues

Many individuals believe that the United States is experiencing a great transformation. How and in what direction this transformation will take place is difficult to say. Herman Kahn perceives a beneficial transformation while Robert Heilbroner is quite pessimistic. The excerpt from the Stanford Research Institute paper, "Changing Images of Man," comments on the significance of our image of man and gives some useful data and projections. An economist's view of the relation between growth and physical constraints is presented by Hueckel.

The last two articles in this group focus on E. F. Schumacher's work, "Small is Beautiful." Schumacher advocates decentralization and restraints on organizational and community size. He offers some realistic, simple steps for resolving some major problems.

Kahn, Herman. Things Are Going Rather Well. The Futurist, v. 9, Dec. 1975: 290–292.
Heilbroner, Robert L. An Inquiry Into the Human Prospect. New York, W. W. Norton & Co., Inc. (1974) 148 p. CB428.H44
Campbell, Joseph and others. Excerpt from Changing Images of Man. Menlo Park, California, Stanford Research Institute, 1974. 319 p.
Hueckel, Glenn, A Historical Approach to Future Economic Growth. Science, V.187, 14 Mar. 1975: 925–932
Cornish, Edward. Think Small. (book review) The Futurist, v. 8, Dec. 1974. 276–280
Schumacher, E. F. We Must Make Things Smaller and Simpler. The Futurist, Dec. 1974: 281–284

Readings on Futures Research Analysis and Forecasting

The readings in this section deal with the techniques available for anticipating change and its consequences and for developing appropriate responses and plans. In the first selection, Wayne Boucher deals with the nature of futures research and describes the state-of-the-art. Joseph Coates describes a number of specific short and long term forecasting techniques; Roy Amara discusses in some depth, with illustrations, the techniques of Delphi, cross-impact analysis, and modeling; and Rene Zentner describes how one company, Shell Oil, actually used the forecasting technique of scenario writing.

One article by Joseph Martino is included for those who ask, "Haven't I been doing this all along?" Another article by Martino, describes some common forecasting mistakes.

Finally, the article by Selwyn Enzer discusses the role of futures research in corporate planning.

Listed below are the citations for the readings in this section.

Boucher, Wayne. Introduction in The Study of the Future: An Agenda for Research. Glastonbury, Conn., The Futures Group. 1974. 2 v. Draft
Coates, Joseph F. Some Methods and Techniques for Comprehensive Impact Assessment. Technological Forecasting and Social Change. New York, American Elsevier Publishing Company, Inc., 1974. (v. 6, no. 4) p. 341–347
Amara, Roy. Some Methods of Futures Research. Menlo Park, California, Institute for the Future, Inc. (1975) 39 p. Working Paper WP–23
Zentner, Rene D. Scenarios in Forecasting. Chemical and Engineering News, v. 53, Oct. 6, 1975: 22–32.
Martino, Joseph P. But Haven't I Been Doing That All Along? The Futurist, v. 6, June 1972: 120–121
Martino, Joseph P. Technological Forecasting for Decision-making. New York, American Elsevier Publishing Co., Inc. (1972) 660 p.
Enzer, Selwyn. The Role of Futures Research in Corporate Planning. Los Angeles, Center for Futures Research, University of Southern California, 1975. 18p.

Readings on Futures Analysis and Government

Two articles are included in order to illuminate the possible relationship between futures analysis and government. Clement Bezold gives an overview of the way in which future-oriented thinking is structured into the legislative process. Donald Schon deals with the government as a learning system, potentially responsive to this kind of analysis.

Bezold, Clement. Congress and the Future. The Futurist, June 1975: 132–142
Schon, Donald A. Beyond the Stable State. New York, W.W. Norton & Co., Inc. 1971. 237 p. HM73.S34

THE LIBRARY OF CONGRESS,
CONGRESSIONAL RESEARCH SERVICE,
Washington, D.C., March 26, 1976.

Hon. JOHN C. CULVER,
Chairman, Panel on Environmental Science and Technology, Committee on Public Works, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to transmit these readings on "Futures Analysis and the Environment" which were selected and compiled at the request of the Panel on Environment, Science and Technology. The readings focus on assisting Members and their staffs in understanding the need for and the potential of futures research.

The readings were selected and compiled by Dennis Little, our Specialist in Futures Research, with the assistance of Keith Bea, Reference Assistant, and Cynthia Huston, Assistant Division Secretary, Science Policy Research Division. The selected readings and related manuscript were reviewed by Walter A. Hahn, Senior Specialist in Science and Technology. The staff of the Committee provided general oversight and direction.

On behalf of the Congressional Research Service, may I express my appreciation for the opportunity to undertake this timely assignment.

Sincerely,

NORMAN BECKMAN,
Acting Director.

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STANFORD RESEARCH INSTITUTE

Center for the Study of Social Policy, W. W. Harman, Director, O. W. Markley, Project Director, Policy Research Report 4, May 1974

CHANGING IMAGES OF MAN

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Excerpt From Chapter 1

Science, technology, and economics have made possible really significant strides toward achieving such basic human goals as physical safety and security, material comfort, and better health. But as Table 1 illustrates, many of these successes have brought with them problems of being "too successful"—problems that themselves seem insoluble within the set of societal value premises that led to their emergence. Improved health, for example, has caused population increases which exacerbate problems of social organization, food distribution, and resource depletion. Our highly developed system of technology leads to a higher vulnerability to breakdowns. Indeed, the range and interconnected impact of societal problems that are now emerging pose a serious threat to our civilization (Platt, 1969; Markley, Curry, and Rink, 1971).

When images "lead" social development they are anticipatory, and provide direction for social change. When images are in this relation to society they exert what Polak (1973) has termed a "magnetic pull" toward the future. By their attractiveness and meaning they reinforce each movement which takes the society toward them, and thus they influence the social decisions which will bring them to realization.

As society moves toward achievement of the goals inherent in the image, the congruence increases between the image and the development of man and society: the promise of the image is explored, needs are satisfied. Then, as with paradigms and myths, there may come a period in which the evolution of the society goes beyond the adequacies of the image. Policies based on the dominant image then become consequently faulty, even counterproductive, precipitating a period of frustration, cultural disruption, or social crisis and the stage is set for basic changes in either the image of man or the organization of society.

Table 1

SELECTED SUCCESSES AND ASSOCIATED PROBLEMS OF THE TECHNOLOGICAL/INDUSTRIAL ERA

"Successes"	Problems Resulting from Being "Too Successful"
Reducing infant and adult/ mortality rates	Regional overpopulation; problems of the aged
Highly developed science and technology	Hazard of mass destruction through nuclear and biological weapons; vulnerability of specialization; threats to privacy and freedoms (e.g., surveillance technology, bioengineering)
Machine replacement of manual and routine labor	Exacerbated unemployment
Advances in communication and transportation	Increasing air, noise, and land pollution; "information overload;" vulnerability of a complex society to breakdown; disruption of human biological rhythmns.
Efficient production systems	Dehumanization of ordinary work
Affluence, material growth	Increased per capita consumption of energy and goods, leading to pollution and depletion of the earth's resources
Satisfaction of basic needs	Worldwide revolutions of "rising expectations"; rebellion against non-meaningful work
Expanded power of human choice	Unanticipated consequence of technological applications; management breakdown as regards control of these
Expanded wealth of developed nations; pockets of affluence	Increasing gap between "have" and "have-not" nations; frustration of the revolutions of rising expectations; exploitation; pockets of poverty

Furthermore, there is no indication that our society, operating under its currently dominant guiding images and value premises, will not continue to create such problems at an increasing rate. Researchers at the Hudson Institute (Kahn and Wiener, 1967; Kahn and Bruce-Briggs, 1972) have identified what they call a "basic long-term multifold trend" that represents a cluster of social forces similar to those causing the "successes" noted in Table 1. According to Kahn and Bruce-Briggs (1972), the multifold trend includes:

(1) Increasingly sensate (empirical, this-worldly, secular, humanistic, pragmatic, manipulative, explicitly rational, utilitarian, contractual, epicurean, hedonistic, etc.) cultures

(2) Bourgeois, bureaucratic, and meritocratic elites

(3) Centralization and concentration of economic and political power

(4) Accumulation of scientific and technical knowledge

(5) Institutionalization of technological change, especially research, development, innovation, and diffusion

(6) Increasing military capability

(7) Westernization, modernization, and industrialization

(8) Increasing affluence and (recently) leisure

(9) Population growth

(10) Urbanization, recently suburbanization and "urban sprawl"--soon the growth of megalopolises

(11) Decreasing importance of primary and (recently) secondary and tertiary occupations; increasing importance of tertiary and (recently) quaternary occupations

(12) Increasing literacy and education and (recently) "knowledge industry" and increasing role of intellectuals

(13) Innovative and manipulative social engineering--i.e., rationality increasingly applied to social, political, cultural, and economic worlds as well as to shaping and exploiting the material world--increasing problems of ritualistic, incomplete, or pseudo rationality

(14) Increasingly universality of the multifold trend

(15) Increasing tempo of change in all the above

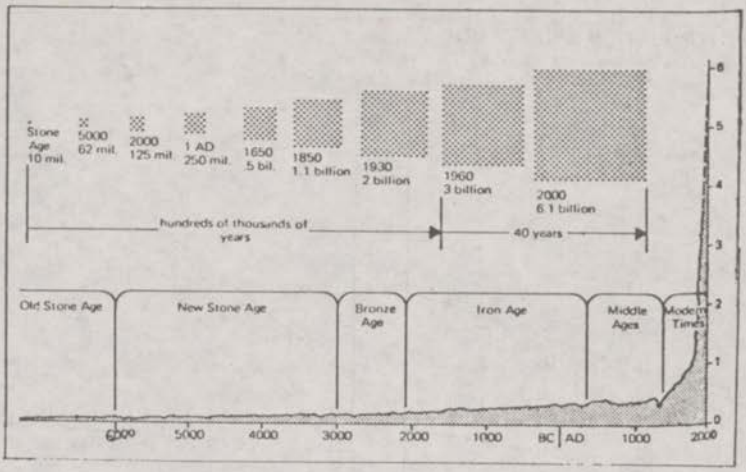
The impact and likely consequences (for better and for worse) of continuing with this societal trajectory can be inferred from a study of Figures 2 through 5. If such projections of the future prove correct, we can expect the associated problems of the trend to become more serious, more universal, and to occur more rapidly.

But the multifold trend (essentially, rampant industrialization and consumption), with the associated problems, need not prove to be the dominant characteristic of our future society. As Figures 2 through 5 imply, for most of human history the growth of man's population was slow and its impact on Earth ecology relatively small. Men lived close to the soil in widely dispersed communities, such that the actions of one community had relatively little impact on most others not near by. But now society grows ever more complex, specialized and interconnected, and the production and distribution of essential goods and services is increasingly dependent on the continued integrity of human institutional systems. Human systems, however, depend on trust, agreement, and political law rather than on unchanging "natural" law, hence they are inherently less stable in times of rapid cultural change than are "natural" systems. They are particularly sensitive to breakdowns caused by war, terrorism and simplistic attempts at societal reform.

Salk (1973) has suggested a simple graphical way of comprehending these changes and the corresponding level of changes that need to take place during the decades to come. As portrayed on Figure 6, the past and future history of mankind can be represented as comprising two phases.

Figure 2

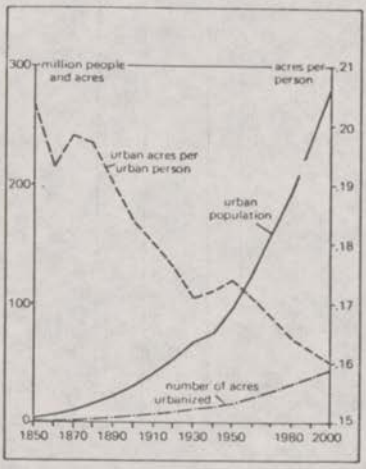
THE GROWTH OF HUMAN NUMBERS



Source: McHale (1972).

Figure 3

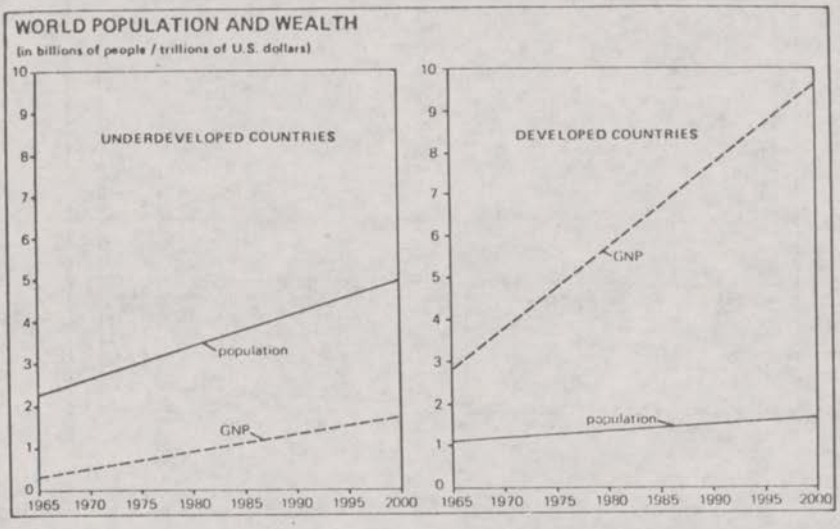
URBANIZATION IN THE UNITED STATES

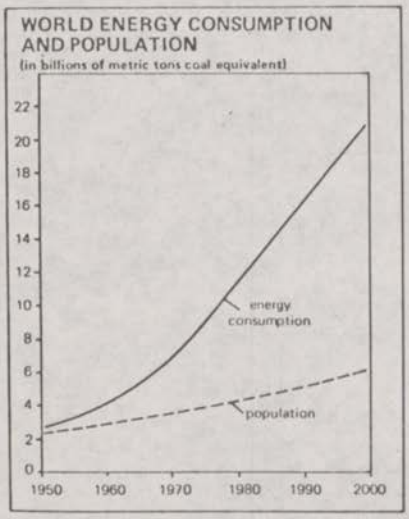


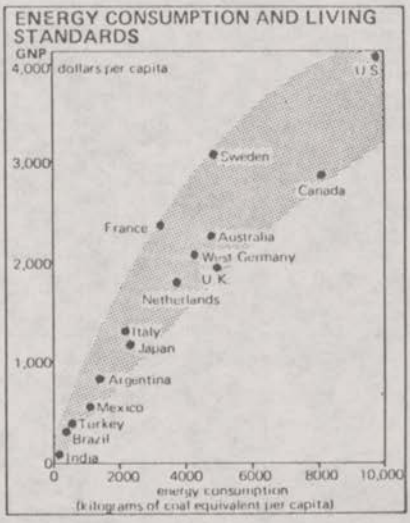
Source: McHale (1972).

Figure 4

SELECTED WORLD POPULATION, WEALTH, AND CONSUMPTION TRENDS



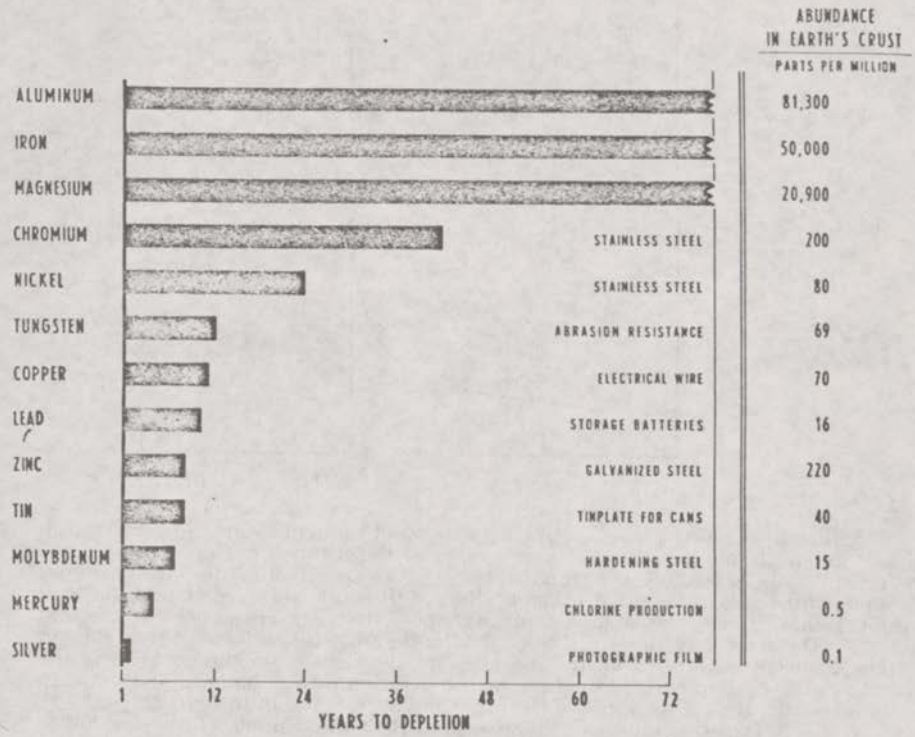




Source: McHale (1972).

Figure 5

DEPLETION OF WORLD RESERVES OF COMMERCIAL GRADE ORES
IF WORLD POPULATION HAD U.S. LIVING STANDARD

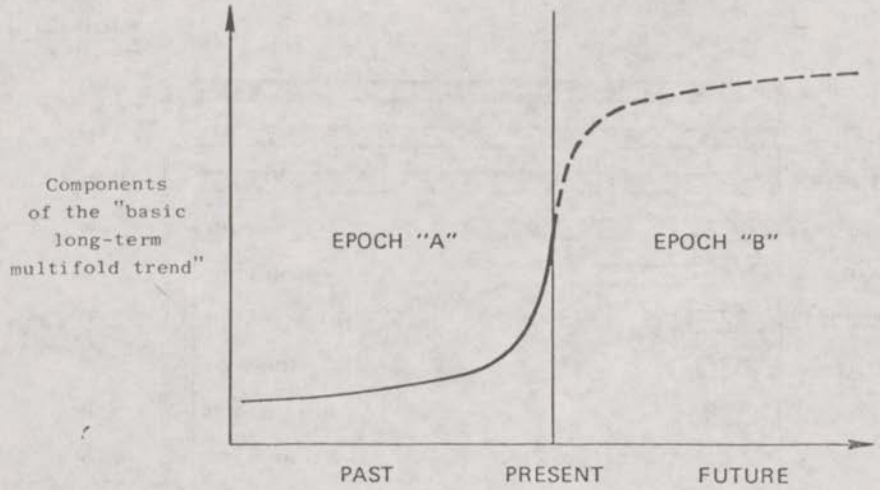


Source: Gough and Eastland (1969), based on data from U.S. Bureau of Mines.

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Figure 6

TWO CONTRASTING EPOCHS OF HUMAN HISTORY (JONAS SALK)



Salk calls the first phase, which includes all of mankind's past history, Epoch A—an epoch in which (for the above reasons) the survival of the human species depended on essentially individual actions, on the survival of the fittest, and on successful competition with other life forms. He calls the second phase, which must characterize any desirable future, Epoch B—a future in which mankind limits the growth of those activities that undermine the welfare of the ecology; hence where the survival of the species will depend more on the behavior of the whole species than of its individuals, on cooperation rather than competition, and emphasizing the survival, not of the physically fittest, but of the *wisest*.

While it is perhaps unrealistic to expect that the United States and other industrial nations would voluntarily limit their own consumption of physical resources and share their wealth more equitably with less affluent nations, it may be equally unrealistic to think that we will not be forced into making just that choice. With only 6% of the world's population, the United States currently uses about half of the world's annual resource output. And it is this standard of living that we enjoy that is the growth goal of most developing nations—most of whose citizens are undernourished and under educated.

As the late Prime Minister of Canada, Lester Pearson, observed: "No planet can survive half slave, half free; half engulfed in misery, half careening along toward the supposed joys of an almost unlimited consumption * * *. Neither ecology nor our morality could survive such contrasts * * *."

While not all researchers agree that such an epochal transition is facing mankind, most agree that the developed nations of Earth now face a series of fundamental dilemmas. By more adequately understanding the nature of these dilemmas, how they have emerged, and how they might be resolved, it should be possible to see new possibilities for a better future.

THINGS ARE GOING RATHER WELL

A State-of-the-World Message From Herman Kahn

Policy analyst Herman Kahn, who became famous in the 1960s for his books about thermonuclear war, here elaborates on his reasons for optimism about the future of man on earth. He also explains why he thinks some people—notably the upper-middle class—are pessimistic. Kahn says he does not see signs of any economic or social collapse, but does believe that many adjustments will need to be made.

Let me give you my picture of the world. There are 4 billion people in the world today. The gross world product is about $5 trillion, which works out to be about $1,250 per person. You may have been told when you were a child that if all the world's income were distributed equally, most people would still be desperately poor, but that isn't true anymore, at least by any historical standard of poverty. If the world's income were distributed equally today, the average income per person would be about three times higher than the richest culture of history before the Industrial Revolution. In other words, the average income today is very high.

How badly distributed is the world's income? It won't surprise you to learn that the majority of people are reasonably poor, but most aren't as poor as you might think. About 1.15 billion people (30% of the world's population) live in the rich Persian Gulf and the developed countries. Another 950 million or so live in Communist Asia. For various reasons, Communist Asia has a higher living standard today than it has ever had in world history. You can call Communist Asia poor if you want, but if a group of nations has achieved a higher living standard than it has ever had before in world history, the adjective *poor* does not seem to be very accurate. And I am not talking about a statistical average person in Communist Asia: The wealth is very well distributed. As far as we know there is almost no serious poverty there. Almost everybody has what the Chinese Communist call the "five guarantees": auequate food, adequate shelter, adequate clothing, adequate medical care, adequate funeral expenses.

About 900 million people live in countries which are moving up rather rapidly. I'm talking about such countries as Brazil, Mexico, South Korea, Taiwan, and Malaysia. In the case of countries like South Korea, Taiwan and Singapore, almost everybody shares in the increase, even if unequally. The increased income is not restricted to the richer half of the population. In Mexico, something like 60–70% of the population share in the increase. In Brazil close to half of the population shares, and the Brazilians are moving up very rapidly; much of that part of the nation which isn't sharing now will be sharing 20 or 30 years hence.

About 1 billion people live in terrible poverty. Right now they have about $100 per capita income. By the end of the century, if things go reasonably well, they might double their income, but more likely the increase will be in the range 20 to 50%. In any case that's still poor by almost any standards, but it represents a large increase over what they have today. And they'll notice the improvement: It will make a difference to them.

My guess is that it will be 100 to 200 years before these desperately poor countries become as rich as the United States is today—and some of them may not make it even by then, though some will be richer. But this is not surprising. The United States in 1776 had about $250 per capita (that's a guess, but I think it's a reasonable one). Today, it has about $7,000 per capita. It took us about 200 years to go from $250 to $7,000. The U.S. was a very well educated country with many resources and had lots of other advantages, so it shouldn't surprise us if it takes the Indians an equal 200 years to go from $100 to $5,000 or $10,000, which is my guess as to about where they will be in a century or two.

Actually, it should be rather easy for poor nations to become rich in 200 years, because it's much easier to develop today than it used to be. The British, the first people to develop, had to do it by their own bootstraps—by entrepreneurship, by innovation, by organization, by rationalization. Today, development is being achieved because of the gap, that is, the differential between the rich countries and the poor. The bigger the gap, the more rapid will be the development.

SPAIN: A CASE OF RAPID DEVELOPMENT

Five of the new driving forces of development can be illustrated by Spain. Spain is doing ve.y well; it is, I think, the seventh largest aut mobile man facturer in the world. Is Spain doing well because of its great talent for development? Not particularly. Then what are the reasons Spain can develop? First of all, tourism. Spain has about 32 million people and each year it receives 35 million tourists, who leave about $3 billion dollars in the country. Tourism solves about half of Spain's balance of payments problems. Why do people go to Spain for tourism? Because there is sun and sand, it's cheap, and the people are pleasant. Why is it cheap? Because of the gap: The tourists come from nearby countries that are rich.

The second reason for Spain's development is exported labor. How can Spain export labor? Again it's because of the gap. The third reason is that industry now wants in many instances to move the work to the labor rather than the labor to the work. That's the basic U.S. and Japanese strategy. It is also, increasingly, the European strategy. As a result, a number of European enterprises are moving to Spain. Why? Once again, it's because of the gap; they can no longer find cheap labor in their own country.

The fourth reason is the Spaniards themselves are catching on. Why? Because they have training, the example of the rich countries, and big markets and credit are available. Why are the big markets available? Why is there credit available? And where do you think the training came from? Again, it's all available because of the gap.

The fifth and final reason is technology transfer. Fifty or 60 years ago there were only about 10 or 12 countries that had steel mills. It was very tough to transfer technology. You really couldn't do it. Today, technology is more typified by the pocket computer that I carry around with me. It cost me $750, as I recall. Twenty years ago the same computing ability would have required a large room and a staff of 10 people. Today I can buy it for $750. I can give it to anybody and he can take it home. No staff is required and it works. All of a sudden he has the ability to do computations which nobody had 15 or 20 years ago. And that's what technology transfer is like today: T.chnology has become terribly easy to transfer.

OPTIMISM FOR FUTURE

The overall prospects for the world are basically optimistic except for two things: One is the possibility of nuclear war and the other is the possibility of misunderstood technology. I can give you a list of 50 problems which we don't understand; any one of these might kill or harm us greatly. Misunderstood technology may result in the earth becoming overheated or overcooled or may cause the destruction of the ozone layer. We may get too much garbage in the ocean, or we may do something else that will destroy us. But I cannot, in good conscience, pick out any one of these for you to worry about because all of them seem to be unlikely. However, there are 50 problems and we only have one earth. Can we improve our odds by slowing down growth? I don't believe it.

One of the main reasons I expect us to survive growth is the enormous surplus that we have in both technilogical ability and money. The United States has $7,000 per capita If we had an accident which reduced our income by a factor of ten, we could still live quite well.

WHY IS THERE CONCERN ABOUT GROWTH?

I would characterize the limits-of-growth people in the following way: You look at a 14-year-old boy and you extrapolate his growth rate. You realize that at that rate he'll be a monster at the age of 25, so you say, "Let's starve him." This is probably the world's worst stragegy. If you wanted to keep the kid small you should have started at birth; now, it's too late.

Why is there such great hostility to growth among upper-middle class elites? The hositility is almost worldwide, but particularly intense in Japan and in the Atlantic-Protestant culture area (Scandinavia, Holland, England, U.S., Canada, and Australia).

The first and most important reason for the hostility to growth is kind of a failure of nerve, an attitude I share. I'm scared by much current technology. I no longer always look at the laboratory with great delight. I approve of some things coming out of the laboratory but not of everything. Let's take one of the most obvious things: Let's assume that by the year 2000 you'll be able to do

enough genetic manipulation so that you can actually order a child by sex, color, size, shape, intelligence, etc. Does anybody believe there will be a huge increase in happiness when you can do this? There are lots of things you are probably better off leaving to luck or not even knowing about.

The next most important reason for hostility to growth is class interest. I recently came back from Southeast Asia, where we had a meeting with about 120 people present—20 Indonesians, 100 Americans. Among these were government officials, academics. The Indonesians earn from $5,000 to $20,000 a year, no graft. The Americans earn from $20,000 to about $100,000. We compared the quality of life between the two groups. The Indonesians have very big houses, two to five times as big as the Americans' homes. The Indonesians have three or more servants—a maid, a cook, a gardener—and the servants are good, because when you give a person a job in Indonesia you are giving him something valuable. The Indonesians have status. The repair man wouldn't dare cheat them; it would be dangerous. If they want girl friends or mistresses, they have them. Look at the Americans. The maid comes in twice a week—if they are lucky—and she isn't very good. The houses are small and provide no status. True, the Americans own cars but so do 50 million other American families. Many of these Americans mow their own lawns, wash their own dishes. I believe that in societies in which the poor largely disappear, and the upper-middle class has to do its own chores, the upper-middle class experiences a decline in its quality of life even though the increasing income benefits the country as a whole. In my own judgment, the decreased quality of life influences the opinions and behavior of the upper-middle class, which becomes an enemy of the economic growth which diminishes the starkness of the gap between the upper-middle class and the poor.

The foregoing article is adapted from Herman Kahn's remarks at the opening of the Second General Assembly of the World Future Society, Washington, D.C., June 2, 1975.

Robert L. Heilbroner

AN INQUIRY INTO

The Human Prospect



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The External Challenges

I HAVE SPOKEN so far of the "mood of our times" and of the personal considerations that make an appraisal of the human prospect so uncommonly difficult. But I have not yet set forth, except in the most general way, the nature of the challenges that we perceive in the world about us. As I have already indicated, the elements of danger in the human prospect are by no means all located in "external" threats, but in our "internal" capacity for response to those threats. Yet certainly the roots of our current anxiety spring in the first instance from dangers that we discern in the world around us, and it is therefore to these that our attention must first be addressed.

If we were asked to identify the principal "external" causes for the mood that assails us, I think that three aspects of the current human predicament would be unanimously selected. The first is a problem so well known that it has almost lost its power to shock, perhaps because attention has been focused largely on its humanitarian rather than its political implications. I refer to the demographic outlook for the next two to three generations.

World population is today roughly 3.6 billion. About 1.1 billion live in areas where demographic growth rates are now tapering off, so that, barring unanticipated reversals in the trends of fertility and mortality, we can expect these areas—mainly North America, Western and Eastern Europe, Japan, Oceania, and the Soviet Union—to attain stable populations within about two generations. These stable populations will be approximately 30 to 60 percent larger than they are now, and this increase in numbers will add its quota of difficulties to the environmental problems facing mankind. But this ecological aspect of the human prospect, which we will examine later in this chapter, must be disentangled from the immediate problem of population overload.

The latter problem concerns the ability of those areas of the globe where population stability is not now in sight to sustain their impending populations even at the barest levels of subsistence. The dangers involved vary in intensity from nation to nation: there are a few areas of the underdeveloped world that are still underpopulated in their human carrying capacity. But in general the demographic situation of virtually all of Southeast Asia, large portions of Latin America, and parts of Africa portends a grim Malthusian outcome. Southeast Asia, for example, is growing at a rate that will double its numbers in less than 30 years; the African continent as a whole every 27 years; Latin America every 24 years. Thus, whereas we can expect

that the industrialized areas of the world will have to support roughly 1.4 to 1.7 billion people a century hence, the underdeveloped world, which today totals around 2.5 billion, will have to support something like 40 billion by that date if it continues to double its numbers approximately every quarter century.

Whether these horrific growth rates will in fact remain unchecked depends on two main variables. The first is the ability of the afflicted areas to introduce effective and stringent birth-control programs. Limited success in this regard has been enjoyed in a few places, mainly Taiwan and South Korea, although it should be noted that this "success" still leaves Korea and Taiwan among the fastest-growing populations in the world.[1] Almost no success has been attained in curbing growth rates in India or Egypt, despite official endorsement of population-control programs, and in those Latin American nations where growth rates are highest, population-control programs are not as yet even advocated. In fact, the only underdeveloped nation for which some cautious optimism may be voiced seems to be mainland China, where population-control programs, reportedly aimed at a zero growth rate by the year 2000, have been introduced with all the persuasive capability of a totalitarian educational and propaganda system.

Elsewhere in the underdeveloped world as a

1. See Kingsley Davis, "Population Policy: Will Current Programs Succeed?" *Science*, Nov. 10, 1967.

whole, population growth proceeds unhindered along its fatal course, with a virtual certainty of an 80 to 100 percent increase in numbers by the year 2000, and with projections thereafter that range between 6.5 billion and a grotesque 20 billion by the year 2050, depending mainly on estimates with regard to the rapidity of "spontaneous" or coerced changes in fertility.[2]

Still more alarming, even given the rise of governments of an efficiency and dedication comparable to that of China, a total curb on population growth appears to be impossible for the next century. This is because the fast-growing countries typically suffer from population age distributions in which almost half the population is below childbearing age. Therefore, even if drastic measures manage to limit families to a maximum of two children within a single generation, the steady advance of larger and larger numbers of individuals into their fertile years brings with it a vast potential increase in numbers. For example, if the underdeveloped countries were to achieve a zero population growth level of fertility by the year 2000, 50 years later they would nonetheless have increased in size two and a half times; if they succeed in achieving the target of "Western" fertility rates only by 2050, they will meanwhile have grown four and a half times in numbers.[3]

2. Tomas Frejka, "The Prospects for a Stationary World Population," *Scientific American*, March 1973.
3. *Ibid.*

For the next several generations therefore, even if effective population policies are introduced or a spontaneous decline in fertility due to urbanization takes effect, the main restraint on population growth in the underdeveloped areas is apt to be the Malthusian check of famine, disease, and the like. According to the 1967 report of the President's Science Advisory Panel on World Food Supply, malnutrition in the underdeveloped nations is already estimated to affect some 60 percent of their populations, with terrible costs in physical and mental retardation, while 20 percent suffer from undernourishment or actual slow starvation. All this contributes to preschool mortality rates three to forty times as high as those of the United States—a human tragedy of immense proportions, but also a demographic safety valve of great importance.

These Malthusian checks will exert even stronger braking effects as burgeoning populations in the poor nations press ever harder against food supplies that cannot keep abreast of incessant doublings. At the same time, the fact that their population "control" is likely to be achieved in the next generations mainly by premature deaths rather than by the massive adoption of contraception or a rapid spontaneous decline in fertility brings an added "danger" to the demographic outlook. This is the danger that the Malthusian check will be offset by a large increase in food production, which will enable additional hundreds of millions to reach childbearing age.

Here the situation hinges mainly on the prospects for the new "miracle" seeds, especially in rice and wheat, which have promised a doubling and tripling of yields. Fortunately or unfortunately, the future of the Green Revolution is still clouded in uncertainty. The new strains have not yet been adequately tested against susceptibility to disease, and there are suggestions from recent experience that they may be subject to blight. Perhaps more important in the long run is that all the new varieties of grains require heavy applications of water and of fertilizer. Water alone may be a serious constraint in many areas of the world; fertilizer is apt to prove a still more limiting one.

"Some perspective on this point is afforded," Paul Ehrlich writes, "by noting that, if India were to apply fertilizer as intensively as the Netherlands, Indian fertilizer needs alone would amount to nearly half the present world output."[4] Judging by the fact that of the 1.6 billion acres of currently cultivated land in the backward areas, less than 7 percent is now planted in the new seeds, a full "modernization" of agriculture would require enormous investments in fertilizer capacity. It is beyond dispute that these investments exceed by a vast margin the capabilities of the underdeveloped nations themselves, and it is possible that they exceed as well those of the devel-

4. Paul and Anne Ehrlich, *Population, Resources, Environment* (W. H. Freeman, 1972), p. 119.

oped world. More sobering yet, the introduction of fertilizers on such a scale may surpass the ecological tolerance of the soil to chemical additives.[5]

The race between food and mouths is perhaps the most dramatic and most highly publicized aspect of the population problem, but it is not necessarily the most immediately threatening. For the torrent of human growth imposes intolerable social strains on the economically backward regions, as well as hideous costs on their individual citizens. Among these social strains the most frightening is that of urban disorganization. Rapidly increasing populations in the rural areas of technologically static societies create unemployable surpluses of manpower that stream into the cities in search of work. In the underdeveloped world generally, cities are therefore growing at rates that cause them to double in ten years—in some cases in as little as six years. In many such cities unemployment has already reached levels of 25 percent, and it will inevitably rise as the city populace swells. The cesspool of Calcutta thus becomes more and more the image of urban degradation toward which the dynamics of population growth are pushing the poorest lands.

Only two outcomes are imaginable in this tragedy-laden historic drama. One is the descent of large portions of the underdeveloped world into a condition of

5. Barry Commoner, *The Closing Circle* (Knopf, 1971), pp. 84–93, *passim*.

steadily worsening social disorder, marked by shorter life expectancies, further stunting of physical and mental capabilities, political apathy intermingled with riots and pillaging when crops fail. Such societies would probably be ruled by dictatorial governments serving the interests of a small economic and military upper class and presiding over the rotting countryside with mixed resignation, indifference, and despair. This condition could continue for a considerable period, effectively removing these areas from the concern of the rest of the world and consigning the billions of their inhabitants to a human state comparable to that which we now glimpse in the worst regions of India or Pakistan.

But there is an alternative—and in the long run more probable—course of action that may avoid this dreadful "solution" to the overpopulation problem: the rise of governments capable of halting the descent into hell. It is certainly possible for a government with dedicated leadership, a well-organized and extensive party structure, and an absence of inhibitions with respect to the exercise of power to bring the population flood to a halt.

What is doubtful is that governments with such a degree of organization and penetration into the social structure will stop at birth control. A reorganization of agriculture, both technically and socially, the provision of employment by massive public works, and above all the resurrection of hope in a demoralized and

apathetic people are logical next steps for any regime that is able to bring about social changes so fundamental as limitations in family size. The problem is, however, that these steps are likely to require a revolutionary government, not only because they will incur the opposition of those who benefit from the existing organization of society but also because only a revolutionary government is apt to have the determination to ram many needed changes, including birth control itself, down the throats of an uncomprehending and perhaps resistive peasantry.

Thus the eventual rise of "iron" governments, probably of a military-socialist cast, seems part of the prospect that must be faced when we seek to appraise the consequences of the population explosion in the underdeveloped world. Moreover, the emergence of such regimes carries implications of a far-reaching kind. Even the most corrupt governments of the underdeveloped world are aware of the ghastly resemblance of the world's present economic condition to an immense train, in which a few passengers, mainly in the advanced capitalist world, ride in first-class coaches, in conditions of comfort unimaginable to the enormously greater numbers crammed into the cattle cars that make up the bulk of the train's carriages.

To the governments of revolutionary regimes, however, the passengers in the first-class coaches not only ride at their ease but have decorated their compartments and enriched their lives by using the

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work and appropriating the resources of the masses who ride behind them. Such governments are not likely to view the vast difference between first class and cattle class with the forgiving eyes of their predecessors, and whereas their sense of historical injustice might be of little account in a world in which economic impotence also meant military impotence, it takes on entirely new dimensions in the coming decades for reasons connected with the changing technology of war. Thus a consideration of the population problem, as the first of the objective challenges of the human prospect, leads to an examination of the problem of war as the second of its imminent dangers.

What is new in the problem of war is, of course, the advent of nuclear weapons with their potential for "irreparable" damage, as contrasted with the much more restricted and more easily repaired damage of most conventional wars. As with the population problem, however, we are in danger of being rendered insensitive to the political ramifications of this element of danger in the human prospect by our tendency to picture it mainly in humanitarian terms.

The humanitarian aspect of nuclear war has focused our attention mainly on the stupendous killing power of the new weaponry. As Hans Bethe has described it:

Let us assume an H-bomb releasing 1,000 times as

much energy as the Hiroshima bomb. The radius of destruction by blast from a bomb increases as the cube root of the increase in the bomb's power. At Hiroshima the radius of severe destruction was one mile. So an H-bomb would cause almost complete destruction of buildings up to a radius of 10 miles. By the blast effect alone a single bomb could obliterate almost all of Greater New York or Moscow or London or any of the largest cities of the world. But this is not all; we must consider the heat effects. About 30 percent of the casualties in Hiroshima were caused by flash burns due to the intense burst of heat radiation from the bomb. Fatal burns were frequent up to distances of 4,000 to 5,000 feet. The radius of heat radiation increases with power at a higher rate than that of blast, namely by the square root of the power instead of the cube root. Thus the H-bomb would widen the range of fatal heat by a factor of 30; it would burn people to death over a radius of up to 20 miles or more. It is too easy to put down or read numbers without understanding them; one must visualize what it would mean if, for instance, Chicago with all its suburbs and most of their inhabitants were wiped out in a single flash.[6]

Our horrified fascination with these and similar statistics has led us to contemplate the consequences of nuclear warfare in terms of the obliterative results of using these weapons *en masse*, unleashing the 11,000 warheads now possessed by the United States or the 1,200 or so warheads possessed by the Soviets. Indeed, there are estimates of such an exchange, with

6. Hans A. Bethe, "The Hydrogen Bomb II," in *Scientific American Reader* (Simon & Schuster, 1953), pp. 194–95.

fatalities ranging from 50 to 135 million for the United States alone, depending on the defense "posture" of the various estimates.

It is understandable that we should be hypnotized by the vision of such ghastly possibilities. The risk, however, is that our concentration on this aspect of the consequences of nuclear warfare will lead us to overlook another result of the new technique of war. Essentially it resides in the fact that many small or relatively poor nations, even though they possess no fully developed industrial base or highly skilled labor force, can gain possession of nuclear weapons. As the example of China has shown, a nation with only a limited amount of industrial capacity can manufacture nuclear warheads by itself, although probably not missile delivery systems. The warheads can nonetheless be launched by bombers, smuggled into enemy harbors by ship, and so on. In addition, poor nations can obtain nuclear weapons as a by-product of the atomic power plants that many of them are now building or contemplating (or that will be built for them in the coming years by the developed countries).[7]

Thus there seems little doubt that some nuclear capability will be in the hands of the major underdeveloped nations, certainly within the next few decades and perhaps much sooner. The difficult question must then be faced as to how these nations might be tempted to use this weaponry. I will suggest that it

7. See Mason Willrich, "International Control of Civil Nuclear Power," *Bulletin of the Atomic Scientists*, May 1967.

may be used as an instrument of blackmail to force the developed world to undertake a massive transfer of wealth to the poverty-stricken world.

It may be, of course, that the governments of the underdeveloped world—and I would emphasize again the revolutionary cast of the governments that can be expected to arise in many places—will be able to arrange for the large-scale assistance they will need, and that they feel is owing to them, without recourse to these means. But given the reluctance to date of the developed world to offer more than token aid, and the likelihood that assistance on a scale large enough to raise the living standards of the six or eight billion of poverty-stricken inhabitants of the poor nations would necessitate an end to any advance, or even a decline, in the living standard of the well-to-do nations, the resort to ultimate tactics is surely not to be dismissed as a mere fantasy.

I do not raise the specter of international blackmail merely to indulge in the dubious sport of shocking the reader. It must be evident that competition for resources may also lead to aggression in the other, "normal" direction—that is, aggression by the rich nations against the poor. Yet two considerations give a new credibility to nuclear terrorism: *nuclear weaponry for the first time makes such action possible;* and *"wars of redistribution" may be the only way by which the poor nations can hope to remedy their condition.*

For if current projections of population growth rates are even roughly accurate, and if the environ-

mental limitations on the growth of output, to which we will turn in our next section, begin to exert their negative influences within the next two generations, massive human deterioration in the backward areas can be avoided only by a redistribution of the world's output and energies on a scale immensely larger than anything that has hitherto been seriously contemplated. Under the best of circumstances such a redistribution would be exceedingly difficult to achieve. Given the constraints on economic growth that will make their presence felt with increasing severity, such an unprecedented international transfer seems impossible to imagine except under some kind of threat. The possibility must then be faced that the underdeveloped nations which have "nothing" to lose will point their nuclear pistols at the heads of the passengers in the first-class coaches who have everything to lose.

Beyond the outlook for a dangerous rise in international tensions for the reasons we have discussed, this "scenario" cannot be further developed with any degree of confidence. Richard Falk has rather melodramatically extended the plot as a series of increasingly grim "decades": the 1970s characterized by a Politics of Despair; the 1980s by a Politics of Desperation; the 1990s by a Politics of Catastrophe; the Twenty-first century as an Era of Annihilation.[8]

I take this macabre prophecy as the worst, not the

8. Richard Falk, *This Endangered Planet* (Random House, 1971), pp. 420f.

most likely, possibility. Even if nuclear blackmail is used, it need not lead to global disaster unless it resulted in an unleashing of nuclear conflict among the great powers. It is more plausible that a terrorist attack—for example, the wiping out of a city in an advanced nation that had refused to pay a ransom of a large portion of its material output—would serve as a stimulus to bring a substantial reduction in nuclear armaments coupled with worldwide nuclear inspections, especially in the "dangerous" underdeveloped countries. Such a protective reaction would not reduce the chances for conventional limited wars—indeed, it might even increase them—but it would greatly reduce the risk of further nuclear threats of the kind we have described.

Unfortunately, even this happiest outcome to the immediate risks of nuclear catastrophe will not remove the influence of war as a fundamental molding element in the human prospect. As we have said, the danger of "limited" war remains, and the probability of such wars is very high. The frequency of "deadly quarrels" showed no signs of decline over the two centuries before 1940,[9] and experience in the past three decades is hardly encouraging: a casually assembled list includes civil conflicts in Greece, Korea, Nigeria, Pakistan, Indonesia, Sudan, and, on a smaller scale, Ireland; minor international sorties led by India,

9. L. F. Richardson, "The Statistics of Deadly Quarrels," in *The World of Mathematics* (Simon & Schuster, 1956), II, 1254.

Pakistan, England, France, Egypt, Israel, Portugal, China, and North Korea; major invasions conducted by the Soviet Union and the United States. Very probably wars on this scale, with this frequency of occurrence, will continue as long as nation-states continue to play their role as the main forms of mass social organization.

It is this last point that is of the essence. The continuing likelihood of war enters the human prospect not alone by virtue of the life-or-death risks it offers, but also as a principal reason for the continuation of nation-states as the dominant mode of social organization. The latter, in turn, gives unhappy assurance that nationalism, with all its potential for historic calamity, will be encouraged by the persisting realities of international existence—the omnipresent threat of war justifying the need for nation-states; the presence of nation-states in turn setting the stage for a continuance of the threat of war. From this vicious circle there is at present no escape, a fact that sets severe limits, as we shall see, on what one can expect by way of a fundamental response to many of the challenges ahead.

We shall return to the problem of the nation-state more than once in our subsequent chapters. But we cannot conclude this examination of the external dangers facing mankind without adding a third problem to those of population growth and war. This is the

danger, to which we have already alluded, of encroaching on the environment beyond its ability to support the demands made on it.

Here we come to a crucial stage of our inquiry. For unlike the threats posed by population growth or war, there is an ultimate certitude about the problem of environmental deterioration that places it in a different category from the dangers we have previously examined. Nuclear attacks may be indefinitely avoided; population growth may be stabilized; but ultimately there is an absolute limit to the ability of the earth to support or tolerate the process of industrial activity, and there is reason to believe that we are now moving toward that limit very rapidly.

When we examine the actual timetable of environmental disruption, however, we soon encounter a baffling set of considerations. Despite the certainty of our knowledge that a limit to growth impends, we have only a very imprecise capability of predicting the time span within which we will have to adjust to that impassable barrier. As we shall see, this makes it difficult to formulate appropriate policies, or to forecast the rate of social change that will be required to bring about the necessary environmental safeguards.

Take, as our initial problem, the availability of the resources necessary to sustain industrial output. In the developed world, industrial production has been growing at a rate of about 7 percent a year, thereby doubling every ten years. If we project this growth

rate for another fifty years, it would follow that the demand for resources would have doubled five times, requiring a volume of resource extraction thirty-two times larger than today's; and if we look ahead over the ten doublings of a century, the amount of annual resource requirements would have increased by over a thousand times.

Do we have the resources to permit us to attain—or sustain—such gargantuan increases in output? Here the problem begins to reveal its complexity. A considerable proportion of the resources we extract today does not become industrial output but ends up as waste. To the extent that we can reduce waste, or use old outputs as new inputs—for example, recycling junked cars as new steel—we will be able to reduce the need for new resources, although by how much no one knows. Further, the problem is complicated because we are largely ignorant of the extent of most of the world's resources, petroleum being perhaps an exception. Indeed, not only is the world still largely "unexplored," so far as its potential mineral and other riches are concerned, but the very definition of a resource changes as our ability to extract minerals or other substances improves. For example, today we utilize enormous reservoirs of iron ore that were not even considered to be reserves when we were still mining the rich iron deposits of the Mesabi Range, now long exhausted. In point of fact, reserves of all known elements exist in "limitless" quantities as trace ele-

ments in granite or sea water, so that, given the appropriate technology and the availability of sufficient energy, no insurmountable barrier to growth need arise from resource exhaustion for millennia to come.

This conclusion depends, however, on several assumptions. It assumes that we will develop the necessary technology to refine granite or sea water before we run out of, say, "copper"—meaning copper in its present degree of availability.[10] More important yet, it assumes that the ecological side effects of extracting and processing the necessary vast quantities of rock or sea water would not be so deleterious as to rule out the new extraction technologies because of their environmental impact. Most important of all, as we shall see, the gigantic energy requirements for mining ordinary rocks or refining sea water bring us to the consideration of whether a continuously increasing application of energy is compatible with environmental safety.

To many of these questions no clear-cut answers exist. We do not know how rapidly new technologies of extraction or refining can be developed, or the degree to which anti-pollution technologies can suppress their ecological disturbance. Today, for example, the practical limit to open-pit mining, which appears to be the most economical way to extract

10. See T. S. Lovering, "Non-Fuel Mineral Resources in the Next Century," in *Global Ecology*, eds. John P. Holdren and Paul Ehrlich (Harcourt, Brace, Jovanovich, 1971); and Preston Cloud, "Mineral Resources in Fact and Fancy," in *Toward a Steady-State Economy*, ed. Herman Daly (W. H. Freeman, 1971).

common rock, is about 1,500 feet. It seems unlikely that this depth can be doubled, and it is a certainty that the rock extracted from such a vast pit will diminish exponentially unless ways can be found to dig pits with vertical walls.[11] In addition, as T. S. Lovering has written, "The enormous quantities of unusable waste produced for each ton of metal are more easily disposed of on a blueprint than in the field."[12]

But even if we make the heroic assumption that all these difficulties will be overcome, so that another century of uninterrupted industrial growth, with its thousandfold increase in required inputs, will face no constraints from resource shortages, there remains one barrier that confronts us with all the force of an ultimatum from nature. It is that all industrial production, including, of course, the extraction of resources, requires the use of energy, and that all energy, including that generated from natural processes such as wind power or solar radiation, is inextricably involved with the emission of heat.

The limit on industrial growth therefore depends in the end on the tolerance of the ecosphere for the absorption of heat. Here we must distinguish between the amount of heat that enters the atmosphere from the sun or from the earth, and the amount of heat we *add* to that natural and unalterable flow of energy by man-made heat-producing activities, such as industrial

11. Cloud, *op. cit.*, p. 61.
12. Lovering, *op. cit.*, p. 45.

combustion or nuclear power. Today the amount of heat added to the natural flow of solar and planetary heat is estimated at about 1/15,000 of the latter—an insignificant amount.[13] The emission of man-made heat is, however, growing exponentially, as both cause and consequence of industrial growth. This leads us to face the incompatibility of a fixed "receptacle," however large, and an exponentially growing body, however initially small. According to the calculations of Robert Ayres and Allen Kneese, of Resources for the Future, we therefore confront the following danger:

> Present emission of energy is about 1/15,000 of the absorbed solar flux. But if the present rate of growth continued for 250 years emissions would reach 100% of the absorbed solar flux. The resulting increase in the earth's temperature would be about 50° C.—a condition totally unsuitable for human habitation.[14]

Two hundred and fifty years seems to give us ample time to find "solutions" to this danger. But the seemingly extended timetable conceals the gravity of the problem. Let us suppose that the rate of increase in energy use is about 4 percent per annum, the worldwide average since World War II. At a 4 percent rate

13. W. R. Frisken, "Extended Industrial Revolution and Climate Change," E⊕S, American Geophysical Union, vol. 52 (July 1971), p. 505.

14. Robert U. Ayres and Allen V. Kneese, *Economic and Ecological Effects of a Stationary State*, Resources for the Future, Reprint No. 99, December 1972, p. 16. See also Frisken, *op. cit.*, and John P. Holdren, "Global Thermal Pollution," in *Global Ecology*.

of growth, energy use will double roughly every eighteen years. This would allow us to proceed along our present course for about 150 years before the atmosphere would begin to warm up appreciably—let us say by about three degrees. At this point, however, the enormous multiplicative effects of further exponential growth would suddenly descend upon us. For beyond that threshold, extinction beckons if exponential growth continues for only another generation or two. Growth would threfore have to come to an immediate halt. Indeed, once we approached the threshold of a "noticeable" change in climate, even the *maintenance* of a given industrial level of activity might pour dangerous amounts of man-made heat into the atmosphere, necessitating a deliberate cutting back in energy use.

In point of fact, serious climatic problems may be encountered well before that dangerous threshold. Noticeable perturbations are anticipated by climatologists when global man-made heat emissions reach only 1 percent of the solar flux, little more than a century from now.[15] This timetable assumes, however, that the rate of energy dissipation will not rise from its present rate of annual increase of 4 percent to, say, 5 percent or even higher. These estimates therefore make no allowance for *increases* in the rate of global heat dissipation if massive industrialization is under-

15. Frisken, *op. cit.*, p. 505.

taken in the underdeveloped regions. Per capita energy consumption in these areas is now only about one-tenth of that of the more advanced portions of the globe, although populations in the backward regions outnumber populations of the industrialized areas by two or three times. To raise per capita energy consumption in the poor regions of the world to Western levels would therefore require a twenty- to thirty-fold increase in energy use in these areas—a calculation that, however staggering, still fails to take into account the potential demands for energy from populations, within these areas, that will certainly double and possibly quadruple over the next hundred years.

It is important, in considering this last element of the human prospect, to avoid a prediction of imminent disaster. The timetable for global climatic disturbance is not only fairly distant, as we are accustomed to judge the time scale of events, but it can be pushed still farther into the future. Increases in the efficiency of power generation or utilization may considerably augment the amount of industrial production obtainable per unit of energy. New technologies, above all the use of solar energy, which adds nothing to the heat of the atmosphere since it utilizes energy that would in any case impinge on the earth, may greatly reduce the need to rely on man-made energy. From yet a different perspective, the technologies required to supplant the

present fossil fuels—safe and efficient fission reactors, economical solar or wind machines, large-scale geothermal plants—may not arrive "on time," thereby enforcing a slowdown in the rate of energy use and postponing the advent of an ecological Armageddon. More important, the vast energy sources required to "melt the rocks and mine the seas," notably fusion power, may also remain beyond our capability for a very long period, thereby curbing our fatal growth curve by depriving us of the needed resources. Finally, a wholesale shift away from material production to the production of "services" that demand far less energy would also greatly extend the period of safety—a possibility that we will look into in our next chapter.

Thus imminent disaster is not the problem here. It is the inescapable need to limit industrial growth that emerges as the central challenge. Indeed, the main lesson of the heat problem is simply to drive home with the greatest possible force the conclusion that such a limitation must sooner or later impose a straitjacket on the never-ending growth of industrial production, even under the most optimistic or unrealistic assumptions with regard to resource availability or technology.[16]

The problem of global thermal pollution, for all its

16. I must add a footnote here, lest it be thought that the availability of safe solar energy obviates the problem of an energy constraint. Ayres and Kneese (page 51) point out that 250 years of growth, with its present associated emission of heat, would reach 100 percent of the total solar flux.

awesome finality, therefore stands as a warning rather than as an immediate challenge. Difficulties of a much more matter-of-fact kind—resource availability, energy shortages, the pollution resulting from noxious by-products of industrial production—are likely to exert their throttling effect long before a fatal, impassable barrier of irreversible climatic damage is reached. Every sign, however, points in the same direction: industrial growth must surely slacken and likely come to a halt, in all probability long before the climatic danger zone is reached.

Once again, however, we must stress an aspect of the environmental problem that is largely overlooked in the mounting literature on the ecological threat. Most of this literature focuses on the technical aspects of the problem, whose dimensions we have generally described. Of far greater importance for the human prospect are its socio-economic and political consequences. It is these aspects which will therefore mainly occupy us in the chapters to come.

There remains one concluding comment, before we proceed. At the outset I said that three elements of the current human predicament would be unanimously

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It follows, therefore, that even the fantasy of a complete capture of all sunlight falling on the earth would yield no more energy than 250 years of growth of conventional (including nuclear) sources. Beyond that lies the exotic possibility of capturing additional solar energy in space and safely relaying it to earth by microwaves, or using microwaves to radiate man-made energy into space. The substantial application of such technologies seems far beyond any realistic capabilities of the next century or so.

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selected if we were to seek the source of the pervasive unease of our contemporary mood. Now, without going beyond the specific dangers of population growth, war, and environmental deterioration, I must identify a fundamental element in the external situation—not so much a fourth independent threat as an unmentioned challenge that lies behind and within all of the particular dangers we have singled out for examination. This is the presence of science and technology as the driving forces of our age.

It is hardly necessary, I think, to spend much time defending the cogency of this unifying proposition. The population explosion that looms with such horrifying possibilities is directly traceable to the consequences of new techniques of science and technology in the area of medicine and public health: it is not a rise in fertility rates but a science-induced fall in death rates that has set off the unstable demographic situation that now threatens to overwhelm the underdeveloped areas. The responsibility of science and technology for nuclear armaments is self-evident, as is also their joint effect in bringing about both the rate of industrial expansion and the peculiarly dangerous nature of modern industrial processes. That science and technology may also be indispensable agents for the mitigation of these external dangers, through birth-control techniques, sophisticated means of arms detection or defense, or greatly improved methods of energy production and pollution suppression, does not

vitiate the contention that these external dangers arise in the first instance because of the development of science and technology in that era we call "modern history."

The very possibility of using science and technology to mitigate our present problems indicates, however, that it is not the extraordinary development of these forces, as such, that underlies our predicament. It is, rather, their fusion in a civilization that has developed scientific technology in a lopsided manner, giving vent to its disequilibrating or perilous aspects without matching these ill effects with compensating "benign" technologies or adequate control mechanisms. In turn, this raises the question of whether scientific research and technological application follow their "own" courses of development, or whether these forces are imperfectly constrained and directed because of inadequacies of the economic and social milieu within which they have arisen.

That is a question for our next chapter. Here it is enough to claim that the external challenge of the human prospect, with its threats of runaway populations, obliterative war, and potential environmental collapse, can be seen as an extended and growing crisis induced by the advent of a command over natural processes and forces that far exceeds the reach of our present mechanisms of social control. It goes without saying that this unequal balance between power and control enters into, or provides the underlying

basis for, that "civilizational malaise" of which I spoke earlier, and to which we will return.

At this point, however, we have still to push beyond the facts, as we can best identify and interpret them, to an analysis of their full impact on the human prospect. We have identified the external challenges; what remains to be examined is the response that can be mustered against these challenges—a response that now appears not alone in curbing or avoiding the specific threats we have mentioned but in coping with the dangerous tendencies of industrial civilization itself.

A Historical Approach to Future Economic Growth

The history of technological advance suggests an optimistic outlook for future economic growth.

Glenn Hueckel

The massive outpouring of literature in the past 3 years assessing the possibilities for future economic growth attests to the great success of Dennis Meadows and his team in their stated purpose to "open . . . debate" on the implications of their "world model" among "a wider community than that of scientists alone" (*1*, p. 23). The importance of such a debate is underscored by the profound policy implications of the work done by the Meadows team and by Jay Forrester (*2*), their methodological mentor. Forrester calls for "an end to population and economic growth" as the only way to avert an alarming future of excessive pollution, natural resource depletion, and starvation all leading to the collapse of modern society (*3*). The Meadows group concludes that the only way to avoid "a rather sudden and uncontrollable decline in both population and industrial capacity" in the next century is to establish a "state of global equilibrium" in which population and the capital stock and, apparently, industrial output are constant (*4*).

The danger with such proposals is that policies to implement them may be demanded before society has had the benefit of a full debate on the problem. Only a few months after the publication of Forrester's *World Dynamics*, the *Ecologist* used that report as a basis for a call for an end to economic growth in Britain and a reduction in British population to 30 million, roughly the level which obtained in 1880 (*5*). Similarly, Anthony Lewis claims (*6*, *7*) that: "The conclusion of the scientists [is that] . . . there is only one way to avoid the pattern of boom crashing into earthly limits. That is to moderate all the interconnected factors: population, pollution, industrial production. *The essential is to stop economic growth*" (emphasis added). These views have also found their way into some textbooks where they are presented as established fact. Hardesty, Clement, and Jencks refer to Forrester's work to support their contention (*8*, p. 89) that ". . . all developed countries, capitalist or socialist, must give up their unquestioning allegiance to the credo that 'more is always better' " and that "It is unavoidable that continued increases in output will eventually overcome the effect of any technological improvement" (*8*, p. 90). They give no suggestion that such "continued increases in output" might spur continuous technological advance. Indeed they argue (*8*, pp. 90–91): "Blind faith in *continuous* future technological developments is foolish when action can be taken now to change man and his institutions."

It is my belief that a historical perspective to this problem indicates that an optimistic view of the possibility for "continuous future technological developments" is not as "foolish" as Hardesty and his collaborators would have us believe. Numerous critics have suggested that the conclusions obtained from the world models are extremely sensitive to the initial assumptions made by the model-builders. Indeed, Boyd has shown that the opposite conclusion of continuous economic advance (though accompanied by an eventual retardation in population growth) can be obtained by altering slightly the assumptions regarding technological change (*9*–*11*). The debate has led several authors to appeal to the historical record. One such author has written, concerning the question of natural resource depletion (*12*, p. 40): "The only hard data which can be brought to bear on this issue are, as usual, historical data; there is no possible way of proving the correctness of a possible future" (*13*). Another study which surveys the technological advance in certain industries since the late 19th century, concluded (*14*) that "the technological component of the world simulation model proposed by Meadows *et al.* and Forrester is best represented by an exponential growth function." Such a view is even more optimistic than that assumed by Boyd (*9*).

Technology and Past Growth

A number of recent studies have indicated that technological change has had a profound effect on past economic growth, having accounted, for example, for half or more of the past increases in net output per capita in the United States and Great Britain (*15*). Although these studies are subject to rather wide margins of error, they generally lead most economists to agree with Musson (*16*, p. 24) that ". . . there is now no doubt whatever of the considerable importance of technical progress, including intangible factors such as educational improvement and growth of scientific and technical knowledge, in the process of economic development." In spite of the importance of technological advance in the phenomenon of economic growth, it has been called the terra incognita of modern economics (*17*); and it is in the exploration of this "unknown land" that a knowledge of past technological change is so helpful.

Technology and the Market

Generally, the historical data support the contention that the direction of technological change is influenced by market forces. As Rosenberg has put it (*18*, p. 37):

> Inventive activity, after all, involves the use of scarce and valuable resources which have a wide range of alternative uses, and therefore even on purely a priori grounds one would not expect to find such resources distributed in a random way among the different sectors of the economy. Like other economic activities, inventive activity is responsive to market forces and the prospects of financial gain.

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This, of course, does not mean that all inventors or all scientists are necessarily motivated by prospects of financial gain, but it does suggest that in the main, the problems toward which people turn their innovative resources are those that promise the greatest financial rewards.

This proposition has implications for both an understanding of past technological change and an assessment of future advance. It undermines the hypothesis that technological advance is of necessity pollution-creating or resource-depleting and thus makes it impossible to argue that the level of pollution in modern society is solely the result of past technological advance. Yet, this is precisely the view implied by the Meadows team when they take "pollution generation" and "per capita resource usage" as functions only of the level of "per capita industrial output." In the case of pollution, the function is simply assumed to be linear; and in the case of resource usage, the functional form employed in the model assumes that as economic growth raises per capita incomes in the rest of the world to the 1970 level in the United States, world resource usage will approach the corresponding U.S. rate (*1*, pp. 102–103 and 107–109; *19*). Such an event is very unlikely, however, because other countries do not possess the same mix of resource endowments and thus will not develop with the same structure of relative input prices as that which characterized the U.S. experience.

Apparently, the Meadows team thinks that the amount of output (which is largely determined by the level of technology in use) is the sole (or, at any rate, the most important) determinant of existing levels of pollution and resource consumption. However, the work of Rosenberg and other economic historians suggests that technological advance is not an "either-or" proposition; there seems to be a surprisingly wide range of alternative possible methods of getting a job done, each method being characterized by a different mix of capital, labor, and resource inputs; and the particular alternative chosen by society is determined by the prevailing structure of the relative prices of those inputs. Thus, if modern technology is lavish in its use of natural resources or excessively polluting, it is because that technology was developed under conditions of very low relative prices for those natural resources and for the privilege of using the environment as a waste receptor.

Resource Prices and 19th-Century Technology

The most striking historical examples of the impact of input prices on the choice of technology in the United States are related to those resources that were most abundant in this country—land and wood. As Rosenberg has noted (*18*, p. 25), ". . . a major thrust of [American] agricultural innovation in the second half of the 19th century was to increase the acreage which could be cultivated by a single farmer . . . ." In support of this statement he cited Parker's finding that some 60 percent of the increase in U.S. cereal output per worker between 1840 and 1911 can be attributed to the rise in the acreage-worker ratio made possible by mechanization.

On the other hand, English agriculture, being characterized by a much lower land-labor ratio, managed a considerable increase in output during the period of that country's industrialization by choosing techniques that raised output per acre at the expense of higher inputs of labor and capital. Far from driving labor off the land, the 18th- and 19th-century enclosures and advances in farming techniques tended to raise labor requirements in agriculture (*20*). However, when the costs of those labor inputs increased relative to capital, as they did during the Napoleonic Wars, many farmers responded quickly to reduce their labor requirements wherever possible. At first this resulted in the increasing use of machines designed to minimize the labor necessary in the winnowing, chaff-cutting, and threshing operations of the farm. Later, after solutions had been found to the more difficult mechanical problems involved, reapers, haymaking machines, and other more complex devices were added to the list (*21*). English farmers were thus able to increase total output and output per laborer throughout most of the 19th century, in spite of their relatively limited ability to increase land inputs, through the substitution of greater amounts of capital.

After 1870, England became increasingly dependent for her food upon the land-intensive agriculture of the United States, Argentina, Australia, and Russia; but this too was the result of further technological change which can be viewed as a response to the opportunities for trade indicated by, among other things, the existing differentials in grain and meat prices between those countries and England. Thus, the application of the compound engine to ocean-going steamships in the mid-1850's brought an immediate 50 percent reduction in coal requirements and contributed to the removal of barriers to long-distance trade in bulky commodities (*22, 23*). Similarly, efforts to develop methods of refrigeration to allow the transportation of fresh meat over long distances began in the 1850's in the major meat-producing countries—Australia, Argentina, and the United States—and finally culminated in 1880 in the successful shipment to London of fresh Australian beef and mutton, which sold at an average price of 5½ pence per pound, well above the prevailing Melbourne price of 1½ to 2 pence per pound (*24*).

During its period of industrialization, the United States had vast forest reserves. According to the 1860 census, the lumber industry was surpassed in size only by the cotton textile industry, in terms of value added by manufacture. Because of this great resource abundance, the American lumber industry developed sophisticated woodworking machinery which amazed European visitors. However, these machines were adopted in Europe to only a limited extent because they were quite wasteful of wood. The same products were manufactured in Europe with slower, more labor-intensive, less mechanized techniques that resulted in far less sawdust on the shop floor. Indeed, Rosenberg quotes one English visitor who, writing in 1872, commented that: "Lumber manufacture, from the log to the finished state, is, in America, characterized by a waste that can truly be called criminal . . ." (*18*, pp. 27–28). However, the American techniques appeared wasteful only to a visitor accustomed to manufacture under a different set of relative prices—a set in which wood was relatively scarce and thus valuable. To American eyes the mechanized techniques did not appear wasteful at all; indeed they were appreciated because they economized on another factor which was relatively scarce in American society—labor.

This ability of society to alter technology to suit the existing resource endowment is further illustrated by the contrast between the forms of steam technology employed in the United States and England. Although developed simultaneously on both sides of the Atlantic in the early 19th century,

the high pressure steam engine was used far more extensively in the United States than in England, where it seldom displaced the low pressure engine as a stationary power plant. The high pressure engine was cheaper to build but apparently was more extravagant in its fuel requirements. Thus, the Americans adopted a technology which allowed them to "buy" a reduction in capital costs for relatively large inputs of natural resources (*18*, p. 65; *25*).

This "trade-off" of capital for natural resources is especially striking in the application of steam to inland water transportation. The steamboats that plied the Western rivers in the United States were built with high pressure engines that made lavish use of the abundant cordwood along those rivers. In the East, however, where fuel was not as plentiful, there was a greater preference for the fuel economy of the low pressure engine (*18*, p. 71). Similarly, one of the selling points of Franklin's "Pennsylvanian Fire Place" was its relatively low fuel consumption —a point of considerable importance for the populous New England and Middle Atlantic colonies and one which Franklin stressed in his published "account" of the new invention (*26*): "Wood, our common Fewel [sic] which within these 100 Years might be had at every Man's Door, must now be fetch'd near 100 Miles to some Towns, and makes a very considerable Article in the Expence of Families . . . since Fuel is become so expensive, and (as the Country is more clear'd and settled) will of course grow scarcer and dearer; any new Proposal for Saving the Wood, and for lessening the charge and augmenting the Benefit of Fire . . . may at least be thought worth consideration."

Resource Scarcity and Technological Change

The point I am stressing, that societies tend to adopt technologies that are compatible with the existing resource endowment, has a corollary that is also supported by historical experience: when that resource endowment changes, as existing supplies of nonrenewable resources are depleted, the techniques in use are adapted to that change through the utilization of new methods of extraction and exploration, through the introduction of substitutes for the resource whose supply is diminished, or (as in the case of the Franklin stove) through the application of techniques to improve the efficiency in use of that resource. Thus Barnett and Morse (*27*) concluded, ". . . the increasing scarcity of particular resources fosters discovery or development of alternative resources, not only equal in economic quality but often superior to those replaced." This past tendency to develop new resources leads economists to argue that while the geological reserves available in the earth's crust are "(almost) infinitely greater" than the 250-year supply which is assumed in the Meadows model (*1*, p. 126), "whether what is geologically available becomes economically exploitable reserves depends on market conditions and the state of resource technology" (*12*, p. 41). Consequently, it is to the omission from the Forrester and Meadows models of any kind of functioning price system that many economists object.

Historically, it has been the increases in price of a given resource as existing supplies are depleted that have stimulated new efforts at exploration, extraction, and substitution. The most dramatic examples of substitution for scarce resources are seen during periods of war when a country is cut off from its traditional supplies. The introduction of the Leblanc process for the production of synthetic alkalis in France during the Napoleonic Wars, the Haber nitrogen fixation process in Germany during World War I, and synthetic rubber in the United States during World War II were all responses to the loss of sources of natural supplies (*18*, p. 21).

War is not the only inducement to this type of technological advance, however. Page (*12*) has reviewed some of the recent improvements in mining and processing technology that have allowed the exploitation of mineral sources that had earlier been ignored. Among these are two advances in the extraction of gold from the ore: the use of mercury first, and later the cyanide process, allowed the exploitation of material which, with the earlier technology, had been considered waste. Likewise, the lowest grade of copper ore that can be utilized has declined from a level of 3 percent in 1880 to about 0.4 percent today. Similar reductions in the lowest feasible grade of ore have taken place in the production of iron, aluminum, and numerous other minerals.

Difficulty of Prediction

This past ability of rising prices to stimulate "resource-saving" technological change implies that reasonably accurate predictions about future resource supplies and usage rates are impossible to make with our present imperfect knowledge of the process of technological change. Such predictions must take into account the likelihood that rising prices will induce a more efficient use of the resource, the introduction of substitutes, and will possibly result in the availability of even greater future supplies through the utilization of new methods of extraction and exploration. These trends have given the lie to numerous past predictions about the rate of resource usage, and there is no reason to believe that predictions made today will not suffer the same fate. Thus, if a 1944 forecast had proved correct, the United States would by now have exhausted its reserves of tin, nickel, lead, zinc, and some 17 other minerals. Instead, the following decade witnessed the discovery of new deposits of these materials containing a greater estimated quantity than that discovered in the previous 25 years (*12*, pp. 38–39).

Predictions of future petroleum supplies which have recently been so prevalent and so ominous share a trait common to past predictions because they are based on the very restrictive concept of "proved reserves." As Landsberg and Schurr have noted, that concept represents the producers' "best estimate of the volume of petroleum in *known* fields that can be profitably recovered with *present* technology" (emphasis added). Thus, rather than being a reasonably accurate measure of future supplies, "The proved reserves may best be thought of as the current working stock or inventory of unrecovered petroleum that producers carry for the efficient accomplishment of their operations" (*28*, p. 27; *29*). The inability to accept this limitation on the concept of "proved reserves" has led to many strikingly inaccurate predictions of future resource depletion. The chief geologist of the U.S. Geological Survey reported in 1920 that only 7 billion barrels of petroleum remained to be recovered with existing techniques. He predicted that, at the contemporary annual rate of consumption of a half-billion barrels, American oil resources would be exhausted in 14 years—by 1934. However, when that fateful year

arrived, 12 not 7 billion barrels had been produced and there was an additional 12 billion barrels of "proved reserves" (*28*, p. 98).

By definition, technological advance implies the discovery of solutions to problems to which no answer is currently available. Thus, we cannot visualize the form and implications of a given solution until the solution has been found. However, even when a particular innovation is perfected, the innovator often does not foresee all its uses. Edison, for example, saw his new phonograph primarily as a business machine, much like the modern dictaphone. Its most important uses, in music and entertainment, were seen by others (*30*). In the same way, railroads were originally conceived as feeders to existing canals, and the early radio devices were thought of only as supplementary to wire communication, to be used where wire could not be employed, as on seagoing ships. We may be tempted to scoff at these and other failures to foresee what seem to us to be commonplace uses of commonplace devices but, as Rosenberg reminds us (*31*), ". . . in history, we always have the immense advantage of knowing how the story ended." It may be more appropriate to base upon these past failures a skeptical approach to modern predictions of the future.

The Past as a Guide for the Future

While society has obviously been very successful in its past technological advance, objections have been raised to the use of that experience as a guide in our contemplation of future resource availability on the grounds that past economic development took place under the especially favorable conditions of resource abundance. Thus Mishan has suggested (*32*): "The advance of technology in the West over the past 200 years might well be attributable to especially favorable circumstances. Certainly there was no problem up to the present of limits to the assimilative capacity of the biosphere. Nor was there a problem of the availability of cheap fossil fuels." However, this view is itself the result of a lack of sufficient perspective.

Rosenberg reminds us that what constitutes a natural resource depends upon the level of technological knowledge achieved by society (*18*, p. 19). Thus, in the early 19th century, crude oil encountered at the earth's surface or in salt wells was viewed as an obnoxious nuisance or, at best, was bottled and sold as patent medicines (*33*). Similarly, the vast coal deposits of England were of little value until the late Middle Ages when it became known that the substance could be used as fuel. Even then, however, coal was of no use in what was to become its most important industrial application until the problem of the mineral impurities imparted by the new fuel to coke-smelted pig iron could be solved. The first step in this long process was not made until the first decade of the 18th century when Abraham Darby developed a new casting process which allowed him to use profitably the lower quality coke-smelted pig iron. However, because the cost of the new mineral fuel remained higher than that of the more commonly used charcoal, the English iron industry did not generally employ coal in the blast furnace until after 1750 (*34*).

In the United States, the rich coal reserves in eastern Pennsylvania went ignored even longer than did English coal. The Pennsylvania deposits consisted largely of anthracite which, because it contains no gas, is very difficult to ignite. Therefore, these deposits could not be utilized in the type of blast furnace developed in England. Not until the development of the hot blast in 1828 (a procedure which, by preheating the blast before it enters the furnace, allows the introduction of anthracite as a fuel) could those eastern coal deposits be put to use (*18*, p. 80).

Thus, from his 20th-century vantage point, Mishan can look back over the relatively short period of a century or two and argue that past economic growth is "attributable to [the] especially favorable circumstances" of mineral resource abundance (*32*). However, it is well to remember that had he lived at the beginning of the 18th century, many of those resources which appear abundant to 20th-century eyes would have been unknown to 18th-century commentators along with the modern uses of two of the most important raw materials of industrialized economies. Indeed, Landes (*23*, p. 41) has suggested that the British Industrial Revolution, that 18th-century outpouring of innovation which so profoundly affected Western society, can be characterized in part as a "substitution of mineral for vegetable or animal substances." Thus, the introduction of coal came at a time when the British economy was facing another "energy crisis": the supply of charcoal could not keep up with the growing 17th- and 18-century demand for fuel (*35*).

Perhaps a more appropriate lesson to draw from the experience of the past two centuries is not to focus on the availability of natural resources but rather to focus on the process by which society was able to advance its technological knowledge to the point where those resources could be employed for the satisfaction of human wants. Can we be so sure that there are not other substances available in equal or greater abundance whose uses as substitutes for present resources we will soon learn? The history of society's past ability to make use of previously unknown resources suggests grounds for some optimism on this question; and Brown clearly admits the possibility of future resource abundance when he writes (*36; 37*, p. 127): "The basic raw materials for the industries of the future will be seawater, air, ordinary rock, sedimentary deposits of limestone and phosphate rock, and sunlight. All the ingredients essential to a highly industrialized society are present in the combination of those substances."

The Desirability of Future Growth

In spite of his assurance of abundant future resource supplies, Brown is rather pessimistic about the desirability of future growth. He worries first that, "We are quickly approaching the point where, if machine civilization should, because of some catastrophe, stop functioning, it will probably never again come into existence" because the abundant natural resources with which that machine civilization was built have been depleted and because the new resources which can be substituted for the old require such highly sophisticated technology. Second, if such a catastrophe is avoided, Brown suggests that the complex technologies of the future will require that man "live in a world where his thoughts and actions are ever more strongly limited, where social organization has become all-pervasive, complex, and inflexible, and where the state completely dominates the actions of the individual" (*36; 37*, pp. 128–129). Thus, it would appear that even if future economic growth is physically possible, it will

create either an extremely vulnerable society or one which is characterized by totalitarian controls.

There is, of course, no doubt that the double-edged sword of technological advance gives man the power either to make life more pleasant or to destroy it; but that is not a very convincing reason to stop growth. It does mean, however, that societies must pay increasing attention to their relations with one another so as to ensure that man's awesome knowledge is never used for the destruction of civilization. But Brown's point relates to the possibility that civilization could be rebuilt after some unforeseen catastrophic event, and here his concern seems rather extreme. He seems to make the error of equating growth with machines. However, Ames and Rosenberg have suggested (*38*) that "one may argue that industrialization is, in large measure, a learning process. The capital stock of any economy includes the acquired skills—technical, managerial, professional—in short, the 'intangible capital' embodied in its living population." Moreover, they have noted that "such skills, once acquired, constitute a major portion of an economy's capital stock" and that to ignore such "intangible capital" can lead to serious prediction errors. Thus, they argue that "astonishment at the rapid rates of postwar recovery in Germany and Japan is due, in part, to persistent failure to give appropriate recognition to the importance of intangible 'human capital' " (*38*). This suggests that while it is possible for some catastrophe to eradicate permanently "machine civilization," as Brown fears, it is rather unlikely since such a catastrophe would have to destroy not only all of society's machines, but all of the accumulated knowledge and skills of its labor as well.

Identifying Value Judgments

This is not the only error that one encounters in the numerous discussions of the desirability of future economic growth. By its very nature, that debate requires that the contribution of each individual be based on his own personal preferences; and thus leads to the incorrect and dangerous assumption that those preferences are held by the rest of society. Beckerman has criticized Mishan, for example, for including in his discussion of the social costs of air travel not only noise and air pollution but also overcrowding at holiday resorts (*39*):

> . . . all this may well be true but to propose, as Mishan does, an international ban on all air travel cannot be justified on these grounds alone. It may be perfectly feasible for a small 'elite' to make their way slowly to Delphi by road and mule, but for the average American secretary or Lancashire textile worker, with only two weeks' paid holiday, it is quite out of the question. To presume that the benefits obtained by thousands or millions of such people from their packaged tours . . . would be less than the loss incurred by a much smaller number of people on account of the disruption of their solitude is either a reflection of a value judgement or an unsubstantiated guess.

Of course, the danger is that those writers who make this "unsubstantiated guess" often base upon it proposals for immediate policy actions which imply as much totalitarian control over individual behavior as Brown fears will be necessary at some point in the future if growth continues. Thus Goodman argues (*40*) that as air travel increases airport congestion, ". . . the less immediate utility it provides, the greater the costs, and the more damaging the remote effects"; because he presumes to judge the level of utility gained by air travelers other than himself, he proposes as a solution that ". . . it is time for technologists to confer with sociologists and economists and ask deeper questions. *Is so much travel necessary?* [italics mine] Are there ways to diminish it?" (*40*).

Most economists would respond that these are the wrong questions to ask. The proper approach is to ask whether those individuals whose actions result in damaging "remote effects" (what an economist would call "external diseconomies") are paying the full social costs of those effects. If the answer is in the negative, then it is the responsibility of the policy-makers to see that such payment is made through the use of effluent charges, minimum air quality standards, higher airport landing fees, or some other control policy. Such policies will, of course, raise the cost of air travel and transfer the costs of the "remote effects" arising from it (or from any other pollution-creating activity) from the rest of society to the individual engaged in that activity. Once this is done, however, the question of the necessity of the travel must be left up to the individual making the trip. In a society that values individual freedom, he is, after all, the only person who has the right to answer that question.

Some economists, recognizing the difficulties involved in making judgments about the satisfaction obtained by others from increased consumption, have tried to prove scientifically the undesirability of further economic growth; but their efforts have simply resulted in a disguised restatement of the value judgments embedded in the work of Mishan and Goodman noted earlier. Thus Daly presents the proposition that ". . . for the poor, growth in GNP [gross national product] is still a good thing, but for the rich it is probably a bad thing"; and he argues that this follows from ". . . the two most basic laws of economics: (a) the law of diminishing marginal utility, which really says nothing more than that people satisfy their most pressing wants *first*—thus each additional dollar of income or unit of resource is used to satisfy a less pressing want than the previous dollar or unit; (b) the law of increasing marginal cost . . ." (*41*). However, this apparently "scientific" justification of a statement, which is in fact nothing more than a reflection of the particular set of preferences held by Daly, is based on an incorrect definition of the "law of diminishing marginal utility." That concept, to the extent that it is a generally accepted "law" of economics, states that the incremental satisfaction obtained from consumption of a *particular commodity* declines as consumption of that commodity increases *while consumption of all other commodities remains constant.* In other words, the "law" of diminishing marginal utility is a statement of the mathematical concept of a partial derivative of a hypothetical utility function taken with respect to a single commodity or service while quantities of all other consumables are held constant. Consequently, since increases in income represent the ability to increase consumption of all goods and services, the "law" of diminishing marginal utility, by definition, cannot be applied to changes in income levels.

The concept that increases in income yield diminishing increments in satisfaction has been around since the 18th century, when it was first proposed by Daniel Bernoulli; and it is still referred to by economists today as the "Bernoulli hypothesis." However, as the phrase implies, it is nothing more than a hypothesis; it is certainly not one of the "two most basic laws of econom-

ics." Indeed, other hypotheses have been formulated to describe the shape of the "income-utility function" which suggest that, over a certain range, increases in income yield rising increments in total utility; and, in many cases, these conform more closely to observed behavior than does the Bernoulli hypothesis (*42*). Thus, the "undesirability" of future growth has not been objectively proved; nor can it be on the basis of the Bernoulli hypothesis for, even if that hypothesis were empirically verified, to use it as Daly does in support of the argument that growth for the poor is "a good thing" while for the rich it is "probably a bad thing" raises the problem of identifying the point at which an individual or society moves from the classification of "poor" to "rich"; and as soon as we attempt to answer that question for individuals other than ourselves we commit the very error that Beckerman has warned against.

Policies for the Future

While the past successes of technological advance suggest grounds for an optimistic view of the future, those successes and the weaknesses in the arguments against growth examined here do not imply that the proper attitude concerning this issue is one of complacency. Indeed, one could argue that the problems which society must face in the future are more difficult than those solved in the past not because they are not amenable to advances in technological knowledge but because changes in certain social institutions are necessary to bring that knowledge to bear on those problems. I have emphasized the proposition that the direction of past technological advance has been a function of market forces: a community allocates its inventive resources to those problems the solutions to which, in view of the prevailing structure of relative prices, appear to offer the greatest financial rewards. While this allocation does not in principle guarantee solutions to a community's problems, it certainly increases the probability that those solutions will be found.

Unfortunately, the common characteristic of most of the problems facing society today is that they relate to commodities or resources for which the unregulated marketplace generates no price information. This failure of the market to generate such information is the result of the lack of well-defined property rights in certain resources; and, to use Hardin's now famous phrase, that failure leads to the "tragedy of the commons" (*43*). Thus, because no one owns the air over a city, no one charges the local manufacturing plant a price for the privilege of using that air as a waste receptor, nor are the residents of the city charged for the pollutants emitted from their automobiles. To make matters worse, those resources are consumed collectively; consequently, even if a price could be set there would be no inducement for consumers to pay unless there was some element of compulsion—a characteristic not found in goods normally traded in the marketplace. Thus, while one need not pay the price of a ticket to a football game, admission to the stadium and enjoyment of the game is impossible without such payment.

On the other hand, even if the residents of a community were charged a price for the privilege of using the air as a receptor for the wastes from their automobiles, there would be little inducement for an individual to pay since he could not be excluded from such use. Such payment could normally be obtained only under some form of compulsion, such as a government requirement for the use of certain control devices or for periodic inspection and the payment of emissions charges. Even in the case of natural resources, where clear property rights are normally established, Solow, Clark, and others have shown that an unregulated market will not result in the socially optimal rate of exploitation if the rate at which society discounts future consumption differs significantly from the prevailing market rate of interest; this suggests, at a minimum, a possible need for government surveillance of the existing rate of exploitation (*44*).

It is clear that nearly all the problems on which Forrester, Meadows, and other antigrowth advocates focus require imaginative and well-considered social policies in which the government intervenes in the marketplace in such a way as to cause it to generate appropriate price signals to both producers and consumers in order to direct the allocation of inventive resources to the solution of those problems. Of course, the precise form of that intervention will be the subject of wide debate; but once the policies are implemented, the record of past technological change strongly suggests that future technology will respond to the new structure of relative prices.

In short, the antigrowth writers are quite correct when they note that the physical resources of the earth are finite. However, they err when they fail to recognize that there is nothing in our past or present experience which suggests the existence of a limit to man's ability to advance his knowledge about that world and about himself and to apply that knowledge to the removal of the physical constraints on continued growth in output and welfare as long as scarcity of the necessities and amenities of life remains a reality for some members of society. Because we are still far from that day when abundance for all is the rule, it is fortunate that the reading of the historical record presented here indicates that the solution to the "predicament of mankind" is not to dissipate our energies in panic and to bring world economic growth to a standstill, but to direct those energies to the development of social policies which will provide the incentives to direct future technology to seek solutions to those problems which some find so ominous.

References and Notes

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2. J. W. Forrester, *World Dynamics* (Wright-Allen, Cambridge, Mass., 1971).
3. ———, *Technol. Rev.* 73, 66 (January 1971).
4. See (*1*), pp. 23–24. The discussion of the "state of global equilibrium" as conceived by the Meadows team (*1*, pp. 156–177) contains certain anomalies that create some confusion. We are told that "population and capital are the only quantities that need be constant in the equilibrium state" (*1*, p. 175). However, apparently that constancy is not crucial since the authors also argue for a "*dynamic* equilibrium" in which "a society could adjust to changing internal or external factors by rising or lowering the population or capital stocks, or both, slowly and in a controlled fashion, with a predetermined goal in mind" (*1*, p. 174). Moreover, we are told that "technological advance would be both necessary and welcome in the equilibrium state"; and certain types of such advance which would "enhance the working of a steady state society" are suggested. They include improvements in pollution control and resource usage and methods of harnessing new energy sources (*1*, p. 177)—precisely those changes that would weaken the "feedback loops" which constrain economic growth in the model. Consequently, it is surprising to read in the description of the simulations of the "equilibrium state" that "the economic system endeavors to maintain average industrial output per capita at about the 1975 level" (*1*, p. 166) and elsewhere that "since the amount of material production would be essentially fixed, every improvement in production methods could result in increased leisure for the population . . ." (*1*, pp. 175–176). Here it would seem that in spite of possible advances in technology which improve productivity and pollution control in the "equilibrium state," industrial output is assumed constant; and, for reasons

which remain obscure, increases in productivity result only in increased leisure time. It is not clear how these apparently conflicting statements can be reconciled.

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19. See also Page (*12*, pp. 33–34); P. K. Marstrand and T. C. Sinclair, "The pollution subsystem," in *Thinking about the Future; A Critique of the Limits to Growth*, H. S. D. Cole, C. Freeman, M. Jahoda, K. L. R. Pavitt, Eds. (Chatto and Windus, London, 1973), pp. 80–81.
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21. E. L. Jones, *Econ. Hist. Rev. Ser. 2* **17**, 322 (1964–1965); A. H. John, in *Land, Labour, and Population in the Industrial Revolution*, E. L. Jones and G. E. Mingay, Eds. (Arnold, London, 1967), p. 35.
22. See D. North, *J. Econ. Hist.* **18**, 543 (1958); M. E. Fletcher, *ibid.*, pp. 556–557; Landes (*23*).
23. D. S. Landes, *The Unbound Prometheus; Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge Univ. Press, Cambridge, 1969), pp. 277–278.
24. Trade in canned meat had existed since the 1860's, but the low quality of this food and the opportunity to trade in fresh meat is indicated by the expression commonly used to describe the canned product: "Sweet Fanny Adams." The expression immortalized the name of a Hampshire woman who, in 1867, was the victim in a particularly gruesome murder in which her body was found cut into small pieces. The morbid humor of the sailors at Portsmouth soon caused them to suggest a connection between that crime and the canned meat they received in their rations. See J. C. Drummond and A. Wilbraham, *The Englishman's Food; A History of Five Centuries of English Diet* (Cape, London, rev. ed., 1957), pp. 322–325.
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THINK

small

One reason that things are getting out of hand is that they have become too big, suggests E. F. Schumacher in his book *Small Is Beautiful*. He would limit cities to 500,000 people.

A Review by Edward Cornish

E. F. Schumacher's book *Small Is Beautiful: Economics as if People Mattered* is a work of stunning brilliance that seems certain to become a modern classic. It is one of those books that can wipe clean the windows through which we look at the world so that we can see many things that formerly were either vague or invisible.

The book has received little attention in the American press so far, perhaps because it has been assigned to economists to review, and it is hardly likely to appeal to the average economist. Though Schumacher himself is an economist, he puts down economics as a vastly overrated enterprise. The central problem of the modern age, Schumacher suggests, is not economics, but metaphysics. He himself quotes Mohandas Gandhi and St. Luke more often than Ricardo and Adam Smith, and a chapter on "Buddhist Economics" offers a serious examination of what economics would be like if it were based on the Buddhist concepts of non-violence and right living rather than the more generally palatable principles of money and greed.

In his introduction to *Small Is Beautiful*, Theodore Roszak, author of *The Making of a Counter-Culture*, says that Schumacher belongs to "that subterranean tradition of organic and decentralist economics whose major spokesmen include Prince Kropotkin, Gustav Landauer, Tolstoy, William Morris, Gandhi, Lewis Mumford, and, most recently, Alex Comfort, Paul Goodman, and Murray Bookchin. It is the tradition we might call anarchism, if we mean by that much abused word a libertarian political economy that distinguishes itself from orthodox socialism and capitalism by insisting that the *scale* of organization must be treated as an independent and primary problem."

Roszak's comment suggests that Schumacher is an idealogue of smallness, but a careful reading of *Small Is Beautiful* shows that such is not the case. It is true that Schumacher advocates decentralization and keeping organizations and communities from getting too big; for instance, he feels that a city should not have more than 500,000 inhabitants. Adding more people does not increase the city's value but rather creates enormous problems and produces human degradation. But it is a mistake to think that Schumacher is a single-minded advocate of smallness. On the contrary, he makes it plain that he is arguing only against "an almost universal idolatry of giantism" that afflicts today's society. If there were a prevailing idolatry of smallness, Schumacher would be arguing just as vigorously on the other side.

The fact that Schumacher's commitment to smallness of scale is provisional rather than absolute offers a key to understanding his basic non-idological approach to economics. He believes that there are no simple answers for human problems, and no final solution but death. Human beings constantly face myriads of conflicting desires and duties that cannot be reconciled with each other; they must make difficult choices and somewhow muddle through. Though they constantly seek the "right" way, they never quite find it except momentarily because circumstances are always changing. Unlike many other thinkers, Schumacher cheerfully accepts the inevitable uncertainty and ambiguity of the human situation and sees it as ultimately good, because the painful struggle to resolve conflicts and surmount what cannot be surmounted brings beauty, truth, and love into human life. Without this struggle, a human being would be a soulless mechanism. Thus, it is no real loss that proposed formulas for solving human problems once and for all are always spurious.

Thus a prime contribution of Schumacher's book is that he makes it clear that the problems of economics do not have any final solution, because they are human problems, that can be "solved" only within a particular set of circumstances for a particular time and particular place.

In addition to his non-ideological openmindedness, Schumacher has a far wider perspective than most economists. He sees economics as merely one aspect of human life, and he takes pains to observe how economics is linked both with other aspects of human life and with the natural environment in which human activities take place. Thanks to this broad non-ideological perspective, he arrives at views that contrast sharply with conventional economic thinking.

One point he makes is that mankind is not yet able to earn a livelihood, but rather is recklessly spending its inheritance of fossil fuels. The coal, petroleum, and natural gas now being used up were not produced by human activity but rather are "the irreplaceable capital which man has not made but simply found, and without which he can do nothing."

"If we treated them as capital items, we should be concerned with conservation; we should do everything in our power to try and minimize their current rate of use; we might be saying, for instance, that the money obtained from the realization of these assets—these irreplaceable assets—must be placed into a special fund to be devoted exclusively to the evolution of production methods and patterns of living which do *not* depend on fossil fuels at all or depend on them only to a very slight extent."

At present, income fuels—water power, wind power, etc.—contribute less than 4% of the total "production" of energy.

"In the foreseeable future they will have to contribute 70, 80, 90%," says Schumacher. "To do something on a small scale is one thing: to do it on a gigantic scale is quite another, and to make an impact on the world fuel problems, contributions have to be truly gigantic."

Even more ominous than the depletion of fossil fuels, Schumacher says, is the exhaustion of living nature herself. In the past, a benign nature has always provided tolerance margins for human activity. Nature could dissipate and render harmless the poisons that man introduced into the environment: the winds scattered the smoke from his chimneys, the rains washed away excessive chemical fertilizers, and microbes broke down organic compounds. In recent years, however, scientists and technologists have learned to compound substances unknown to nature, and these now pose a serious threat.

"Against many of them, nature is virtually defenseless. There are no natural agents to attack and break them down . . . It is only in the last 20 years or so that they have made their appearance *in bulk*. Because they have no natural enemies, they tend to accumulate, and the long-term consequences of this accumulation are in many cases known to be extremely dangerous, and in other cases totally unpredictable."

Thus the modern industrial system now "consumes the very basis on which it has been created. To use the language of the economist, it lives on irreplaceable capital which it cheerfully consumes as income."

"Our most important task is to get off our present collision course," Schumacher says. "We must begin to see the possibility of evolving a new lifestyle, with new methods of production and new patterns of consumption: a lifestyle designed for permanence."

Even if reserves of fuel could be found for the future, Schumacher says, the consumption of fuel on the scale suggested by current projections "would produce environmental hazards of an unprecedented kind." Thus economic growth must eventually stop due to environmental considerations, even if it might continue from the point of view of economics, physics, chemistry, and technology.

In discussing the limits to economic growth, Schumacher stresses the energy problem. "It is impossible to overemphasize its centrality. It might be said that energy is for the mechanical world what consciousness is for the human world. If energy fails, everything fails."

"As long as there is enough primary energy—at tolerable prices—there is no reason to believe that bottlenecks in any other primary materials cannot be broken or circumvented. On the other hand, a shortage of primary energy would mean that the demand for most other primary products would be so curtailed that a question of shortage with regard to them would be unlikely to arise.

"Although these basic facts are perfectly obvious, they are not yet sufficiently appreciated. There is still a tendency, supported by the excessively *quantitative* orientation of modern economics, to treat the energy supply probelm as just one problem alongside countless others."

Prosperity May Not Bring Peace

Besides suggesting that economic growth must stop, Schumacher attacks the widely prevalent notion that universal prosperity would provide a sound foundation for world peace. "One may look in vain for historical evidence that the rich have regularly been more peaceful than the poor," he notes. Thus it is "chimerical to build peace on economic foundations which, in turn, rest on the systematic cultivation of greed and envy, the very forces which drive men into conflict."

While downgrading the importance of material wealth, Schumacher argues that work is actually a good in itself, or at least produces non-material goods whose importance should not be minimized.

Work is not "an inhuman chore as soon as possible to be abolished by automation," but rather something that is needed for the good of man's body and soul. "Next to the family, it is work and the relationships established by work that are the true foundations of society," says Schumacher.

In his chapter on Buddhist economics, he suggests that work has at least three functions: "to give a man a chance to utilize and develop his faculties; to enable him to overcome his egocenteredness by joining with other people in a common task; and to bring forth the goods and services needed for a becoming existence."

Work and leisure are "complementary parts'of the same living process and cannot be separated without destroying the joy of work and the bliss of leisure."

Schumacher calculates that only 3½% of "total social time" (all the time possessed by everyone) is devoted to the actual production of goods. He arrives at this very low figure by estimating that only about one half of the total population of Britain is gainfully occupied and only about a third of those are in agriculture, mining, construction, and industry. Thus rather less than one sixth of the total population spends its time of genuine production. (He refuses to count as producers those people who "tell other people what to do or account for the past, or plan for the future, or distribute what other people have produced.")

Technology has enabled society to reduce the amount of time actually spent on production in its most elementary sense to such a tiny percentage of total social time that it pales into insignificance and carries no real weight, let alone prestige. Confining productive time to 3½% of total social time has had "the inevitable effect of taking all normal human pleasure and satisfaction out of the time spent on this work. Virtually all real production has been turned into an inhuman chore which does not enrich a man but empties him."

Modern technology has "deprived man of the kind of work that he enjoys most, creative useful work with hands and brains, and given him plenty of work of a fragmented kind, most of which he does not enjoy at all. It has multiplied the number of people who are exceedingly busy doing kinds of work which, if it is productive at all, is so only in an indirect or 'roundabout' way, and much of which would not be necessary at all if technology were rather less modern."

Schumacher proposes that rather than see work gradually decrease asymptotically to zero under the influence of automation, we should set a goal in the opposite direction: Work should be increased six fold, so that 20% of total social time would be used for actually producing things. Under this new regime, "even children would be allowed to make themselves useful, even old people. At one sixth of present-day productivity, we should be producing as much as at present. There would be six times as much time for any piece of work we chose to undertake—enough to make a really good job of it, to enjoy oneself, to produce real quality even to make things beautiful. Think of the therapeutic value of real work; think of its educational value. No one would then want to raise the school-leaving age or to lower the retirement age, so as to keep people off the labor market. Everybody would be welcome to lend a hand. Everybody would be admitted to what is now the rarest privilege, the opportunity of working usefully, creatively, with his own hands and brains, in his own time, at his own pace—and with excellent tools."

Schumacher's concern with *increasing* the amount of productive work dovetails with his interest in intermediate technology, which he says can be viewed as self-help, democratic, or people's technology. Intermediate technology can be used by everyone and is not reserved to those already rich and powerful. It will help make people self-reliant and independent, and enable the poor to lift themselves out of poverty.

The Non-Material Causes of Poverty

Schumacher maintains that the causes of extreme poverty do not lie in the realm of material lack, but in "certain deficiencies in education, organization and discipline."

"Development does not start with goods; it starts with people and their education, organization, and discipline. Without these three, all resources remain latent, untapped, potential. There are prosperous societies with but the scantiest basis of natural wealth, and we have had plenty of opportunity to observe the primacy of the invisible factors after the war. Every country, no matter how devastated, which had a high level of education, organization, and discipline, produced an 'economic miracle.' In fact, these were miracles only for people whose attention is focused on the tip of the iceberg. The tip has been smashed to pieces, but the base, which is education, organization, and discipline, was still there."

Schumacher says that economic development cannot be an act of creation, cannot be ordered, bought, or comprehensively planned, but requires a process of evolution. "Education does not 'jump'; it is a gradual process of great subtlety. Organication does not 'jump'; it must gradually evolve to fit changing circumstances. And much the same goes for discipline. All three must evolve step by step, and the first task of development policy must be to speed this evolution."

In many parts of the world today, the poor are getting poorer, and the established processes of foreign aid and development often seem to promote their improverization. A principal cause, Schumacher suggests, is the "negative demonstration effect" of a sophisticated technology introduced into an unsophisticated environment. A tractor imported into a developing country may actually discourage development in that country because the local farmers know that they cannot make such tractors by themselves with local resources; the farmers thus lose their self-reliance. More helpful would be equipment that they could make for themselves, using materials that are readily available.

In summary, Schumacher argues for a higher degree of thoughtfulness both in the way we apply technology and in the general conduct of our affairs. "Man is far too clever to be able to survive without wisdom," he says. "No one is really working for peace unless he is working primarily for the restoration of wisdom."

"From an economic point of view, the central concept of wisdom is permanance. We must study the economics of permanance. Nothing makes economic sense unless its continuance for a long time can be projected without running into absurdities. There can be 'growth' towards a limited objective, but there cannot be unlimited generalized growth. It is more than likely, as Gandhi said, that 'Earth provides enough to satisfy every man's need, but nor for every man's greed.' Permanence is incompatible with a predatory attitude which rejoices in the fact that 'what were luxuries for our fathers have become necessities for us.'

"The cultivation and expansion of needs is the antithesis of wisdom. It is also the antithesis of freedom and peace. Every increase of needs tends to increase one's dependence on outside forces over which one cannot have control, and therefore increases existential fear. Only by a reduction of needs can one promote a genuine reduction in those tensions which are the ultimate causes of strife and war."

Help Unwanted

Schumacher tells an anecdote to illustrate the tragic irony of economic policies that emphasize goods rather than people. He was visiting a textile factory in a developing country of Africa, and the manager was proudly showing it off because, he said, it was one of the most modern in the world.

"Before you go on," said Schumacher, "can you tell me what's happening outside, because as I came through there were armed guards there, and you are beleagured by hundreds and hundreds of Africans."

"Oh," said manager, "Take no notice of that. These are unemployed chaps and they hope that I might sack somebody and give them the job."

"Well," said Schumacher, "as you were saying, you have one of the most modern factories in the world."

"Oh yes," said the manager, "You couldn't find anything better."

"How many do you employ?"

"Five hundred. But it's not running perfectly yet; I am going to get it down to three hundred and fifty."

"So there's no hope for those chaps outside?"

"The people demand perfect products and these machines don't make mistakes. My job is to eliminate the human factor."

"If you make such a perfect product, why are you here in this wretched provincial town and not in the capital city?"

"It was that stupid government that forced me to come here."

"I wonder why."

"Because of the unemployment in the provinces."

"We Must Make Things Smaller and Simpler"

An Interview with E. F. Schumacher

In an interview with THE FUTURIST, E. F. Schumacher suggests that mankind is now on a reckless spree, spending up its inherited resources of fossil fuels. The rapid disappearance of cheap fuels will make our present economic system non-viable. Thus industry will have to move toward smaller units of production, and this will lead to new lifestyles that will emphasize people rather than products.

THE FUTURIST: Dr. Schumacher, what sort of reception has your book had?

SCHUMACHER: In England? It was published about the end of June last year and all I know is that it has been reprinted four times as a hardback. I've never got around to asking the publisher how many copies he printed each time, but he is delighted, so I'm quite satisfied.

THE FUTURIST: The point that I'm more interested in is what's been the reaction to the dissemination of your ideas? Are there people who now consider you a new guru or is your book viewed as a political manifesto?

SCHUMACHER: Frankly, I do not know. All I know is that I get mountains of correspondence. The book, as you know, is not really a book, that is, I didn't sit down and write it. Each chapter has grown out of my special interests and preoccupations. For example, there's a chapter about nuclear energy—against nuclear energy—so the people who share this view are very excited about it. There is also a part about organization, management, and ownership that interests another constituency.

As for the book being a political manifesto, I think that we are past the time when the primary considerations are political, particularly along party lines. We now live almost in a post-political age. The book cuts right across the usual politics, whether Tory or Labor or Liberal or extreme right or extreme left. There are people on all sides that have smelled a rat about the direction in which we are moving. The strength of my book is that it is not just a dreamer's book. It shows problems that one can deal with. But whether anyone *will* deal with them is another question. Actually, I don't think the Government *can* deal with many of the problems; the solutions must come from the grass roots. Only then can we have a regeneration of society.

THE FUTURIST: In your writings you state that you think one of the most erroneous views underlying present economics is the idea that the problem of production has been solved. Would you elaborate on this?

SCHUMACHER: Virtually all production, including industrial production, depends on energy, and the energy is derived not from production but from nature's storehouse. We have "solved" the problem of production by turning oil into wealth. But the oil is finite in quantity, so the problem isn't really solved: The oil will run out. Look at it this way: Here is oil that is a once-and-for-all endowment of the earth. We take this oil and use it by turning it into all sorts of products which can be used to turn other materials into products. To say that we have solved the problem of production by using oil is to a large extent like saying that someone who's inherited a fortune from a rich aunt has solved the problem of earning his keep.

One of the most basic facts about our industrial system is that fossil fuels are not income, but capital. They are what we have inherited and we're just using them—and using them at a steadily accelerating rate. If I've inherited 10,000 pounds, I can have a spree for five or six months and that's the end of it: I haven't solved the problem of my livelihood by having the spree. In business we distinguish between using income that we earn and using the capital that we started with. We provide for depreciation, so that we have enough money in the kitty to restore the situation as before. But we don't do that in our economies as a whole: we just use up our capital—our fossil fuels—and we count as cost only what it costs us to fetch our inheritance out of the ground.

Take the American oil or natural gas situation. The oil production has been going on at a greatly accelerating rate for about 100 years and not only is oil more and more difficult to find but in fact it's not been possible to expand its production in the U.S. any more. Oil production reached its peak about 1970 and the projections are now that it will go down, not because people will not make more effort but because the oil just isn't there—at any rate, it's not there accessibly. It's a fool's paradise to imagine that cheap and plentiful oil will continue forever and ever, and that an economy built on cheap and plentiful oil can continue unchanged.

THE FUTURIST: Are there directions in which we can move to begin to rethink this problem of production? What is it that we should be doing now?

SCHUMACHER: We should look very calmly at what's happened over the last 100 years, and of course, most importantly in the last 30 years, since the second world war. We find that man has created a technology, a style of production, a style of consumption, and a style of settlement that are all dependent on cheap and plentiful fossil fuels. Now if these fossil fuels are no longer cheap and plentiful, what are the consequences? The technology that we have developed is ex-

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tremely dependent on oil and is what you might call oil-intensive. This is illustrated in agriculture, but also in building styles, transportation, and the distribution of production units.

Our society has an immensity of transport: If I travel from London to Glasgow on one of the big motorways, I find myself surrounded by huge lorries carrying biscuits from London to Glasgow and I look across to the other lane and I find an equal number of lorries carrying biscuits from Glasgow to London. Any impartial observer from another planet would come to the conclusion that biscuits, in order to achieve proper quality, must be transported at least 500 miles. Now this criss-crossing of transport can be explained in economic terms only because transport is cheap, and it is cheap because oil is cheap and plentiful. If oil becomes expensive we can't carry on like this. We'll price ourselves out of the market with this transport.

THE FUTURIST: Could you elaborate further on the changes that we might expect in society as fossil fuels become more expensive?

SCHUMACHER: To understand them it is necessary to realize that a basic characteristic of technological development has been its creation of ever bigger units in order to increase its efficiency. For example, in the brick industry a hundred years ago a brickworks would produce 10,000 bricks a week. Fifty years later the standard was about 100,000 bricks a week. Now it's about a million bricks a week and they're talking about two, three, four, or five million in the future. If you produce ever more bricks in one place you must cart into that place all sorts of materials and more importantly you have to disperse the product over a very wide radius. The bigger the production unit, the more transport it entails. So this big unit is made possible through cheap transport, and now we have big units.

But if oil ceases to be cheap and plentiful, the most viable units will be small. We will then have local production from local resources for local use. For this mode of operating we have no technology now. Of course, I'm not talking about spices and other things that you cannot produce locally, and I'm not talking about total self-sufficiency; I'm talking about a particular development of non-self-sufficiency and geographical specialization in large units which has been made possible primarily by the cheapness and plenty of fossil fuels, particularly oil and natural gas.

THE FUTURIST: Some people feel—and in some of your presentations you have alluded to it—that we're approaching a very critical point in history and that there is a major crisis emerging in our society that will necessitate large-scale social reorganization. Could you elaborate on what you see as the reasons that the crisis is emerging?

"If I travel from London to Glasgow on one of the big motorways, I find myself surrounded by huge lorries carrying biscuits from London to Glasgow and I look across to the other lane and I find an equal number of lorries carrying biscuits from Glasgow to London. Any impartial observer from another planet would come to the conclusion that biscuits, in order to achieve proper quality, must be transported at least 500 miles."

SCHUMACHER: I talk in my book about a three-fold crisis. First, at the level of man, there is a sociological crisis, with people and societies becoming more and more ungovernable. The symptoms of sickness are seen in steeply rising crime rates which have risen to a height that was not known before the second world war. In addition, we have drug addiction, truculence, discontent, and so on. You name it and we've got it. Somehow, sociologically we have an inability to solve problems. As a European I look at the United States economy and I read the statistics that the income per head is twice that of western Europe. Now if more income and more production can solve the problems, then surely the problems should have been solved in the United States. But they're every bit as big in the U.S. as they are in Europe, and in many cases bigger. Poverty has not been eliminated in America. So that is what's happening to human beings.

As for non-human living nature, you have all the environmental scares. Nature is telling us, "I can't take it any more. I'm breaking down. The burden you're placing on me is greater than I can bear." And beside the sociological crisis and the environmental crisis, we also have a resources crisis. Suddenly you find people alarmed, and they are often the same people who for decades have been saying there is nothing to worry about. Many years ago, in the early 1950s, President Truman established the Paley Commission to find out about U.S. resources, and the Commission reported that the resources were finite, but nobody took the slightest notice. All sorts of clever people said science would invent solutions, but now these same people are not so sure.

If you want a diagnosis, I come to the conclusion that our problems have a lot to do with technology which, although it is a human creation, moves somehow by its own laws without any kind of limits. While man may shape technology, technology becomes a very powerful force and starts developing by its own laws. And then technology starts shaping man, just as when a man builds a house and then lives in it, the house does a great deal to shape his personality and character. In the last 30 years, technology has been moving ahead at an accelerated rate in four directions:

First, ever increasing size of units. Things are mass-produced by ever bigger machines. That's what I call giantism. We are now far beyond the normal human scale and have reached a point where a factory spews out articles at such a rate that they have to travel around the whole globe.

Second, a tendency to let things become ever more complex. This complexity is very often created for the most trivial reasons, such as eye appeal. This applies even to fruit. There's a tremendous deployment of human science and ingenuity for pest controls so that apples should come out completely unblemished and all the same size—solely for the sake of eye appeal. The finest apples that we have in Britain—Cox's orange pippin—look quite shabby and have some blemishes, but, my goodness, they taste like paradise. Most apples from Australia and California don't. The unblemished apples require a tremendous expenditure of ingenuity and technology. People say that there are more scientists and technologists alive today than in all previous history put together, so you can see how complex society must have become to find employment for those chaps.

Third, the immense amount of capital that you have to have under your control to do almost anything. (This point is interconnected with points one and two.) In his book, *The New Industrial State*, John Kenneth Galbraith relates how the Ford Motor Company got started with a capital of $30,000. Who can start a motor car company today with $30,000? It's got

nothing to do with inflation: If you double or treble this amount to allow for inflation, the question changes little. Who can start a motor car company with $100,000? A motor car company has become so complex and the scale that is necessary is so great that you have to be immensely rich or powerful to start one.

Now these three points—giantism, complexity, and high capital intensity—serve to exclude more and more people. The days are gone when a little chap who lives frugally for a few years and accumulates a little capital can set himself up and become productive and perhaps even rich—unless the chap stumbles on a unique invention. The ordinary chap can't personally do anything, so he just becomes a job seeker. Some people never desire anything more than becoming job seekers, but not all of them. The really energetic people would like to do their own thing, but technological development has made this virtually impossible, not totally but virtually.

A fourth point is that technology is becoming too violent, especially with regard to the environment. In modern agriculture, for example, we don't work with the rhythms of nature. We don't use a piece of land in accordance with the condition of the soil, and we don't save certain strains of plants when they don't produce high yields. We've got agri-business and agri-industry, or what some people call hydroponics. The soil is simply the mechanical support for the plant, which is then fed by chemical fertilizers. The health of the plant and the quality of its food are not much of a consideration, because if there should be any infestation or disease, it is killed off by insecticides, fungicides, or herbicides. This I call a violent technology.

After all, the globe has only an extremely thin film of living soil and we are bombarding it with a vast array of poisons. Mind you, we are finding again and again that poisons which have been used for many years and have been hailed as wonderful achievements are suddenly prohibited because people have discovered—after using them for decades—that they are not harmless. So we are really playing poker with the very existence of biological life. Human beings with judgment are no longer able to do things; it's now machines churning away.

THE FUTURIST: Given that we've come to this crisis point, what directions can we move in to begin to create a more positive future?

SCHUMACHER: Recognizing the four trends—giantism, complexity, capital intensity, and violence—suggests the direction in which we should be looking. The questions we must raise are: Can't we make things smaller, so that they're not so oppressive? Aren't there simpler solutions? Do things have to be so complicated and complex? Can't modern knowledge produce equipment that's not so expensive? Finally we must deliberately say, "No, this technology is too violent. We want a non-violent, soft technology."

I'm not suggesting that we redirect 100% of our research and development in this opposite direction, but that we should do some research on these questions. If 5% of the research and development expenditures of American industry were devoted to looking in the opposite direction, you would discover (as we are discovering in our own work) that you can make things small, so that small people can make themselves productive. You can make things far simpler. You can devise technological methods so that people can start with very little capital and you can achieve a much greater degree of non-violence and that's really worth going for. And then if a cataclysm or other real difficulties come, you have a chance of survival.

"The questions we must raise are: Can't we make things smaller, so that they're not oppressive? Aren't there simpler solutions? Do things have to be so complicated and complex? Can't modern knowledge produce equipment that's not so expensive?"

THE FUTURIST: Can you give us some practical examples of where these ideas are being implemented?

SCHUMACHER: Let's take farming. It's no longer a matter of debate among knowledgeable people that you can achieve just as high yields with organic methods. Organic farming is possible and productive, although it's not easy to make a living at it in a society supported by chemical farmers. There are many organic farmers who make a very good living and have very high productivity per acre without all the backing of official research which helps the chemical farmers. In Britain the government expenditure per annum for agricultural research is about 35 million pounds per year and none of it supports organic farming. All the research is for the benefit of chemical farmers, with the exception of plant breeding, which helps organic farmers also.

Nothing is done specifically to solve the problems of organic farming, and yet we have organic farmers in Britain, in the United States, in Australia and in many countries making a good living and achieving good yields. The inputs which they require from industry are minimal. They are not bothered now—except for certain mechanical equipment—by the petroleum crisis. So let's put some effort behind this. Let's learn from these people. Let's spend some of the immense amounts spent of research and development to find out about compost piling and so on. We can develop more suitable equipment. You know a combine harvester used to have a little appliance that collected the weed seed, but not any more. Why? Because we have herbicides that just kill the weeds, so we don't mind where the seed falls. This is a brutal way of going about farming. The organic farmer needs a harvester which will have an appliance to collect the weed seeds.

In fact, I know of many farmers who tinker about and design such appliances by themselves. But you don't get a good job done with pure amateurs. We have lists and lists of problems that the organic farmers are crying out to get attention paid to, but no one takes any notice. These problems should be attended to, and it wouldn't cost 35 million pounds a year to do this research. A small percentage of the current expenditure for agricultural development would take care of the proper requirements of this alternative system.

A similar approach can be applied in other areas: If we develop a more decentralized mode of production we will find that carrying biscuits from Glasgow to London and simultaneously from London to Glasgow is not very clever. We would also find that we must consider more than new transport technology, because an intelligent person doesn't try to solve transport problems merely by using new gadgets and streamlining (as we do inside a factory); instead he would solve the problem by minimizing the *need* for transport, that is, by arranging things so that goods from the factory don't have to be shipped criss-cross all over the place.

Now let's consider industry: I think that a non-violent technology, based on small units, that lends itself to use by people who are not very sophisticated or very rich and powerful would be a blessing in every respect. The moment you have smaller communities which the mind can encompass, people realize that they *are* somebody and they *do* count. That creates a feeling of responsibility and then if they are responsible citizens instead of just masses, they will also behave responsibly.

I admit that is a bit speculative, but

through intermediate technology and small scale operations we could achieve a social structure that is far more ecologically sound, soft on resources, and sociologically satisfying than what we have now. For example, in an industry where production units of a thousand tons a day is considered normal, we have had design studies made which show that one 150th of that scale—6-1/2 tons a day—is also economical. We have developed a machine for the production of packaging material for eggs where we reduced the scale to 2% and also cut the capital cost to 2%, and it was fantastically economical, because instead of having one unit we could have fifty.

A large and complex unit requires top-level management and all sorts of systems, whereas a unit 2% of that size can be managed without any bureaucracy. It can be managed in your head, as it were. The ideal is to have a minimum of administration, not a maximum, because administration is very difficult. If it's badly done, it ruins the whole thing. And people who can do this very difficult job well are not very common, and those very able people really want to do the actual job. If you drag them up to the top of the large organization, then you're missing them down below. And if you have people at the top who are not masters of the art of administration, then the first-class brains you have down below get frustrated. Transport, size, administration—one should look upon them as things to be minimized, not maximized.

THE FUTURIST: Could you distinguish between appropriate and intermediate technology? Do you see a difference between them?

SCHUMACHER: I started both these terms. In development economics, everyone took technology for granted. But I said that the rich man's technology is not necessarily appropriate for poor countries and that it cannot be appropriate for rural areas. What would be an *appropriate* technology? Something intermediate—intermediate between the very low level of technology that exists in the rural areas of the third world and the very highly sophisticated technology that the rich countries deploy. If you ask me how I define intermediate, that's just what I've been doing when I state these four criteria: Intermediate technology will tend towards *smallness* and *simplicity*. It won't be very capital intensive, and it will tend in the direction of non-violence. It will fit into the rural areas and will be within the reach of poor people.

THE FUTURIST: Do you see this as the technology of the future or do you see nuclear fission or nuclear fusion as tomorrow's technology?

SCHUMACHER: I'm not prepared to really talk about fusion because I know that the time to develop that technology is going to be very long. You will not see any measurable contribution to world energy supplies through fusion in your lifetime, and I certainly won't see it in my lifetime. The lead time is far too long. We have an energy problem now! We have no experience on earth of the sun-like temperatures necessary for the fusion reaction. And if you imagine that this degree of violence can occur on this earth without ecological and other consequences that nobody even dreams of, then I think you are just dreaming. So fusion is out for any sensible discussion. Now nuclear energy is already a reality and to me the most terrifying, the most depraved, and the most irresponsible technology that exists because of its radioactive byproducts.

THE FUTURIST: There is almost a wave breaking in the publishing industry of dystopian or very pessimistic literature. Probably the most popular one in this country is Robert Heilbroner's book, *An Inquiry into the Human Prospect*. Others, like Roberto Vacca's *The Coming Dark Age*, have received some attention in Europe. What do you view as the real prospect for the future?

SCHUMACHER: I once reviewed Heilbroner's book *The Great Ascent* and I said that this man is a dreamer. He's gone in his psyche on this great ascent, and after the great ascent comes the fall into despondency. I think it's an inevitable reaction of any man against his earlier totally unjustified, fantastic optimism. I think we should take a very sober view, and the sober view is the view of people who are prepared to do some work. I mean that if somebody tells me that the oil supplies to Great Britain will be cut in half, that reduction would mean a reduction of about 30% in total supplies. Well, only 30 years ago we used about 60% of what we're using now and we had a decent society and nothing to be afraid of.

The only thing to be afraid of is fear and despondency and the paralytic reaction to changes which prevents people from doing anything. Let's get down to work. Let's look at agriculture, at transport, at industry, at the distribution of population, at all our arrangements, and let's get busy. There are lots of people who are already in tune to the problems and we can do something. Sitting around moaning doesn't help. I have no sympathy with two classes of people—the doom-watching pessimists, because they just spread paralysis, and the Herman Kahn-type optimists, who are the blind leading the blind.

What we need are what I would call optimistic pessimists who can see clearly that we can't continue as before, but who have enough vigor and joyfulness to say, all right, so we change course. I know it can be done and it will be done if people are not paralyzed by either the optimists or the pessimists.

THE STUDY OF THE FUTURE: AN AGENDA FOR RESEARCH

Chapter 1

INTRODUCTION

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THE FUTURES GROUP

Glastonbury, Conn. (1974)

INTRODUCTION

Astrologers, mystics, chiromancers, prophets, psychics, haruspices, and other kinds of soothsayers and seers, including priests and princes, have traditionally had the corner on forecasting, and even today these worthies have by far the greatest influence of all those who deal with the future, affecting (as they do) the expectations and actions of hundreds of millions of persons daily. This situation is not likely to change in the foreseeable future, but the twentieth century has witnessed the first concerted and sustained efforts to make it change. Indeed, these efforts--directed mainly toward making forecasting less of an art and more of a science--have not only begun, but have in fact become more and more widespread, organized, and sophisticated, particularly since the end of World War II, when, in Jacob Bronowski's words, the atomic bomb brought civilization "face to face with its own implications." The conviction is now increasingly shared that it is no longer merely profitable or helpful to explore as carefully as possible the course of trends and the likelihood of potential events. It is necessary. The explanation--as this magnificent and yet terrible century has demonstrated more than once--is that without keener foresight, without a more responsible anticipation, some highly desirable possibilities will certainly be missed and some current decisions will have regrettable, perhaps disastrous, consequences in a tomorrow that could materialize so quickly that man would be powerless to do anything to protect himself from them.

Looking at the future has thus taken on a very serious side. And as a vocation or advocation, it has also become something of a growth industry throughout the world, for accompanying this change in attitude toward the future, and to some extent causing it, has been the invention or rediscovery of new analytic capabilities, the creation of new institutional forms, and the development of new outlets for expression, as well as a steady growth in possible clients and actual funds--all dedicated in one way or another to gaining greater insight into the real opportunities for choice and the implications of the use of these opportunities.

No one knows just how extensive this activity is, whether in number or type of institutions involved, number or background of practitioners, levels or sources of funding, number or kind of studies, or whatever. But various national and international surveys make the total number of individuals and groups strikingly large, so large, in fact, that it is possible to speak without exaggeration of a worldwide futures movement. This movement may be characterized roughly as embracing all of those persons, whatever their affiliation, engaged in forecasting or prediction with a view toward taming the future--leashing it where necessary, domesticating it where possible. They thus deny the implicit premises of the soothsayers that the future is totally outside of man's control and that, at best, it can merely be foretold apodictically. And while their approaches to foreseeing or inventing the future vary across a spectrum that includes narrow economic or technological forecasting, the writing of science fiction, the establishing of communes, and rioting in the streets, they are as one in behaving as if they thought that the achievement of at least some desirable alternatives rests entirely upon conscious

action, that action rests on decisions, that decisions rest on forecasts, and that forecasts rest on reasonable excursions into the plethora of imaginable tomorrows.

The growth, size, and composition of the futures movement is indicated, albeit only approximately, by the surveys mentioned before. For example, Erich Jantsch, in his pioneering study in 1966 which took him into the United States, Western Europe, and Israel, found about 100 organizations with a permanent forecasting activity, of which more than 60 percent, not unexpectedly, were in industry, with the rest distributed among government, academia, and independent research centers such as The Rand Corporation.[1] Extrapolating from these 100 cases, he estimated that just in the United States some 500-600 corporations had an in-house capability; additionally, he concluded that about 500 corporations (many of them included in the preceding group), plus an uncounted number of government agencies and foundations, drew upon the forecasting services provided by outside private or non-profit firms.

Between 1968-1970, the Long-Term Planning and Policy Division of the Council of Europe surveyed forecasting in ten countries of Western Europe.[2] Of the 292 organizations which it identified, 101 were governmental, 66 were in universities, 12 were non-governmental international organizations

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[1] Erich Jantsch, Technological Forecasting in Perspective (Paris: Organisation for Economic Co-Operation and Development, 1967). Despite its early date, this volume remains one of the few indispensible books on the philosophy, techniques, and uses of forecasting.

[2] "European Inventory of Long-Term Forecasting Activities," Futures Vol. 2, No. 4 (December 1970), p. 387.

(e.g., Europe 2000), and the remaining 113 were private or independent non-profit groups.

A global survey was undertaken in Spring 1970 by De Hoghton and others in England.[3] They identified and sent a questionnaire to 490 individuals and organizations (including ad hoc groups) that they considered to be part of the futures movement. Responses were received from 269 sources in academia, government, industry, foundations, and elsewhere. Another measure of international activity can be found in the annual surveys conducted for the past few years by the IRADES group in Rome. For example, the 1972 directory lists about 200 organizations, principally non-governmental, that specifically claim to specialize in forecasting. In total, however, some 700-800 persons and organizations are listed--thus including many of the friends and acquaintances of the futures movement.[4]

John McHale of the State University of New York in Binghampton has conducted two important surveys of forecasting in the United States, the first in 1969-70, the second in 1971-72.[5] The growth in the number of

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[3] Charles De Hoghton, William Page, and Guy Streatfeild, ...And Now the Future: A PEP Survey of Future Studies, Vol. 37, Broadsheet 529 (London: PEP, August 1971).

[4] Social Forecasting: Ideas, Men, Organizations, Activities (Rome: IRADES, 1972). Incidentally, the annual directories published by IRADES are unquestionably the best source of information on the movement, even though the user must endure all of the problems that one would expect when editors whose native language is Italian receive questionnaire responses in many different languages and then issue them in English, without benefit of professional translation.

[5] John McHale, Typological Survey of Futures Research in the U.S. (Binghamton, N.Y.: Center for Integrative Studies, School of Advanced Technology, State University of New York, 1970), and A Continuation of the Typological Survey of Futures Research, U.S. (Binghamton, N.Y.:

practitioners between the two studies is suggested by the data in the table below. In each study, government on all levels accounted for only about 5 percent of the responses. Most of the responses came from individuals (who may or may not have been affiliated with an organization concerned with forecasting), but after them, industry was most important

PARTICIPANTS	NUMBER	
	1969-1970 Survey	1970-1971 Survey
Invited (institutions and individuals)	356	527
Responses	139	204

(with over 20 percent of the responses), followed by the universities (which went from 10 to 15 percent between the two surveys), the non-profits (with some 10 percent), and then, in much smaller percentages, associations and religious groups.

From time to time, W. W. Simmons of Applied Futures, Inc., in Connecticut, surveys organizations, as well as ad hoc groups and publications, throughout the free world that appear to be involved in what Simmons calls "exploratory planning," which he defines as the search for alternative futures in the period about 15 years from the present. These

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Center for Integrative Studies, School of Advanced Technology, State University of New York, 1972). As of August 1974, a third study was in progress. These reports contain a good deal of additional detail on the movement, such as the academic training of the participants, areas of professional interest, size of their organizations, methods used, and so on.

reviews are informal and lay no claim to being comprehensive, but the results are interesting in that they tend to confirm what other studies show about the growth of interest in studying the future and the distribution of the work among various sectors. The results from the first two reports are shown in the table below.[6]

SECTOR	NUMBER OF RESPONSES	
	Nov. 1972 Survey	Oct. 1973 Survey
Corporations and business associations	25	44
Government agencies (U.S. and foreign)	16	34
Independent centers (private, non-profit, academic, etc.)	44	79
TOTALS	85	157

Finally, there are the results from a survey made by The Futures Group in August-November 1973 during the course of research for this book. The aim of the survey was to determine the kinds of research projects currently being conducted around the world having to do with the advancement of forecasting itself.[7] Because it was important to the objectives of the research project as a whole to contact as many organizations as could be found, the studies mentioned above, as well as a number of other sources, were reviewed carefully to extract names and addresses.

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[6] W. W. Simmons, Exploratory Planning Briefs (Greenwich, Conn.: W. W. Simmons, November 1972 and October 1973).

[7] A summary of the survey results is presented in the Appendix.

Altogether, 937 institutions in 42 countries were identified, of which perhaps 850-900 appeared to have completed at least one substantive futures-oriented project within the last few years, assuming a very generous definition of what constitutes a futures project.

Of the 937 organizations invited to complete The Futures Group's questionnaire, 532 were based in the United States, 90 were from elsewhere in the Americas (mainly Canada), 224 were in Western Europe, 36 were in the USSR and Eastern Europe, and 55 were from other areas (primarily the Far East). About 15-20 percent of the invitees responded--a reasonable figure, considering the question that was asked--and, for these respondents, the percentage distribution among sectors was as follows:

Individual	5.4%
Industry	23.6
Government	8.1
Independent Research Center (private or non-profit)	23.6
Association	9.5
University	29.8

In short, while the numbers vary widely from survey to survey, a few inferences can safely be made from these data: First, no less than one hundred organizations in the United States, plus probably an equal or greater number in the rest of the world, are willing to associate themselves with the futures movement, and most of these organizations are actually practicing forecasting, at least part of the time. Second, the number of persons involved is no doubt many times greater than the

estimate of organizations. Third, the number of individuals and organizations in the futures movement has grown rapidly and may still be growing.[8] Finally, most work is being performed in organizations, and of the organizations, about 50-80 percent worldwide are non-governmental; that is, they are industrial groups, academic centers, private or non-profit consulting firms, voluntary groups, and so on.

Many other signs provide additional evidence of the sudden burgeoning of a serious futures movement. Most dramatic perhaps is the post-World War II outpouring of books, articles, reports, newspaper stories, newsletters, and other publications concerned with the future, either as an object of possible study (e.g., essays on the philosophy or practice of forecasting) or as a repository of potential developments warranting actual study (e.g., the future of the family, the future of ocean shipping, the future of the Common Market). The 1971 IRADES directory, for example, contained a bibliography of 3000 items; another effort in the same period led to the cataloguing of more than 20,000 titles. Neither count, however, is even remotely indicative of the actual publication record since 1945.[9] But they do point in the right direction, and they

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[8] Allowance must be made, of course, for the fact that those who conduct the surveys are becoming better at identifying potential respondents. My own impression is that the growth in organizations has essentially stopped, except in academia, while the number of practitioners is continuing to rise, but at a much slower rate than in the 1960-1970 period.

[9] The bibliography in this book includes some 1500 titles, which is merely a small subset of titles drawn almost exclusively from the English-language literature of just the last decade on the possibility of studying the future. Moreover, it omits the substantive work, which is easily the largest category. If a substantive futures publication can be defined as a self-contained document (book, news magazine article, or whatever) that

also highlight the fact that "the futures literature" has begun to be recognized as a separate category. This is signaled as well by the appearance and increase over recent years of journals and newsletters specializing in articles on or about the future.[10]

Beyond publications, there are other signs. The upsurge in meetings and conferences explicitly devoted to the future could be mentioned, and if there were time series data on these affairs (which there are not),

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includes at least one forecasted event that can be unambiguously confirmed after the projected date of occurrence as having occurred or not occurred (e.g., the GNP of the United States will reach $2 trillion in current dollars by 1982), I estimate that at least 100,000 such publications now appear annually in English alone. But this is a very conservative estimate indeed, even for English-language items, for, among other things, it leaves totally out of account all of those publications that project trends or that include those very interesting and sometimes very important forecasted events which are too imprecisely stated to be confirmed after the fact or which either posit desirable goals or declare intentions.

[10]It would, however, be a mistake to read too much into this development, important though it is to the establishment of forecasting as a discipline, since most popular, academic, and technical journals have always carried such articles. Proof of this observation, if proof is needed, can be found in Michael Marien's "A World Institute Guide to Futures Periodicals," Fields within Fields, No. 12 (Summer 1974), pp. 65-96, which describes, in addition to 18 non-English periodicals and 19 futures newsletters, the 100 English-language periodicals Marien judged to be "most relevant to the future." Not surprisingly, the list of 100 includes the three or four futures journals (The Futurist, Futures, Technological Forecasting and Social Change, Long-Range Planning); not surprisingly either, the rest of the list consists of publications that would be known to most intellectuals, but hardly be considered by them to be futures-oriented, despite an occasional article on forecasting, planning, change, or the future. This is not a criticism of Marien's "Guide," which can serve several purposes; but it is a reminder that one need only specify his criterion for identifying a "futures periodical" and such a list can fall readily into hand. (Marien's basic criterion was this: "If a periodical seemed to me to promote broad and creative thinking [about the future] that is also rigorous and responsible, and of potential benefit to mankind interests, then it was included.") The significant point is that almost all journals and magazines have more and more frequently published articles on the future.

they would probably show at least a ten- or twenty-fold increase over the past 30 years. Allowing for every kind of subject matter, from the future of printed circuits to the future of mankind, from the methodology of forecasting recidivism to the methods of modeling global dynamics, it is plausible to imagine that, on an annual basis, an average of two or three such meetings are held every day somewhere in the world, and that this number is increasing.

Even more noteworthy is that members of the futures movement have increasingly begun to train (and thus multiply) their successors. This is happening in non-academic settings (such as the Industrial Management Center headed by James Bright[11]), and in the established forecasting organizations (which provide on-the-job training), but also in the educational system, on all levels. On the college and university level in the United States and Canada, where the pattern has been investigated, the results may well be representative of changes in other countries. In 1968, only about a dozen schools were offering courses for credit on the study of the future; in 1969, there were about 30; in 1970, there were 60; by 1972, the number had doubled or tripled again. Similarly, from 1970 to

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[11] In 1967, the Industrial Management Center offered what appears to have been the first course, outside of academia, on technological forecasting, and this activity has continued since then. The first course is documented in James R. Bright (ed.), Technological Forecasting for Industry and Government: Methods and Applications (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968). Taken together with Jantsch's book (fn. 1), as well as the 1962 report by Ralph Charles Lenz, Jr., Technological Forecasting, 2nd Edn., Report ASD-TDR-62-414 (Dayton, Ohio: Wright-Patterson Air Force Base, Aeronautical Systems Division, June 1962), this volume captures very well the state-of-the-art in technological forecasting in the 1960's.

1972, the number of courses offered at these schools increased from about 40 to nearly 200 (and perhaps as many as 400, if the data are extrapolated to the entire population).[12] Most disciplines appear to have their futurist now; as Eldredge puts it, "Practically every imaginable subject has been futurized, every problem stretched into the future in this quite amazing hodge-podge of courses."[13]

As suggested earlier, and as even the raw numbers presented so far would seem to indicate, "hodge-podge" may not be a bad description of the totality of aims, activities, and accomplishments within the futures movement itself, despite apparent agreement on one or two basic principles. Fortunately, it is not the purpose of this book to critique or attempt to impose a rational structure on the entire movement, the very fecundity of which seems in fact to depend primarily upon its uniquely ebullient and probably unanalyzable diversity. Rather, the main concern

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[12] These figures are from H. Wentworth Eldredge, "Education for Futurism in the United States: An On-Going Survey and Critical Analysis," Technological Forecasting and Social Change, Vol. 2 (1970), pp. 113-148; Billy Rojas, "Teaching the Future," Change (January-February 1971), pp. 17-19; and H. Wentworth Eldredge, "A Mark II Survey and Critique of Futures Research Teaching in North America," Technological Forecasting and Social Change, Vol. 4 (1973), pp. 387-407. Eldredge and Rojas, who have worked together on these surveys, began a third study in 1974. It should be mentioned that these surveys go far beyond counting schools, courses, professors, students, and subjects. They provide what is perhaps the best account of current thinking within academia about the value of studying (or teaching about) the future. Another excellent source of information is David C. Miller and Ronald L. Hunt, A Graduate-Level Survey of Futures Studies: A Curriculum Development Project (Washington, D.C.: Office of Education, U.S. Department of Health, Education, and Welfare, August 31, 1972); see, as well, Harold G. Shane, The Educational Significance of the Future (Bloomington, Ind.: Phi Delta Kappa, Inc., 1973).

[13] Eldredge, "A Mark II Survey and Critique," p. 399.

in this volume is with a single small segment of the futures movement: the work of those persons and organizations engaged in what has come to be called futures research.

Though the term "futures research" has achieved general currency,[14] it still is without an accepted definition. A few years ago, John McHale made an effort to discover what those who said they were practicing futures research meant by the phrase. Regrettably, the differences between the answers were so great that a synthesis was not possible.[15] Outcomes like this have led a number of observers to conclude that the issue is "not very important anyway" and that it would be far better to "get on with it"—whatever "it" is--the argument being analogous to the one expressed in the saw that "geometry is what geometricians do." Obviously, a person can be a successful futures researcher (or geometrician) without being able to define his field, and yet, just as obviously, it would be helpful to have a definition, particularly for the use of students, potential participants, and clients outside the field who

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[14] Over the years, a great many other names have been used: futurology, futuristics, futurism, future studies, future research, mellontology, prognostics, and so on. Except as noted later in the text, these may be taken as rough synonyms for each other and for "futures research."

[15] For a sampling of the definitions, see Appendix G (pp. 69-72) of the first of the two studies cited in fn. 5. The sample is fascinating throughout. Consider, for example, just some of the genera used in the definitions: "the study of..."; "the assessment of..."; "the process of study, analysis and simulation of..."; "the effort to..."; "the study, forecasting, design, and realization of..."; "an organized technique for..."; "an investigation of probability that is..."; "educated guesses about..."; "the search for..."; and so on. Predictably, the specific defining terms following these phrases are even more varied.

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are uncertain as to how futures research differs from other kinds of forecasting or who might wish to consider what it means to "do" it.[16]

The contributors to this volume who would call themselves futures researchers and who actually attempt to define the term in these pages are no more in agreement with each other than are similar authors elsewhere. Or so it seems, if the words they use are taken literally. Nevertheless, there is a possibility, with a bit of history to support it, that the differences may be superficial and that a definition can be framed to which they and most other practitioners of futures research would assent. This possibility, which arises precisely through examination of contemporary papers and reports by futures researchers (that is, through study of what they "do"), lies in viewing futures research as a branch of systems analysis.

Of course, systems analysis itself is not easily defined, but E. S. Quade of The Rand Corporation, where it all started, has articulated one of the better definitions--and one which is adequate for our purposes here. After reviewing (and dismissing) several narrow formulations, which amount to equating systems analysis to a particular method, a fixed set of methods, or a kind of report, Quade concludes:

> We would suggest that, properly speaking, [systems analysis] is a research strategy, a perspective on the proper use of the available tools, a practical philosophy of how best to aid a decisionmaker with complex problems of choice under uncertainty. In the absence of a good brief definition, systems analysis...can be characterized as a systematic

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[16] It might also be useful to those introspective individuals within the field who must certainly wonder from time to time about what it is they are "doing."

> approach to helping a decisionmaker choose a course of action by investigating his full problem, searching out objectives and alternatives, and comparing them in light of their consequences, using an appropriate framework--in so far as possible analytic--to bring expert judgment and intuition to bear on the problem.[17]

The 51 words in italics were written with great care; they compress much and they clearly demand a close reading. But there is no mistaking five of the key ideas in this definition. First, systems analysis is emphatically not a particular activity; it is an "approach" to a particular activity. As such, it is not a task that is either done or left undone, but rather a "research strategy" that is either adopted or not adopted.[18] Second, systems analysis is policy oriented: the analyst's principal role is to provide various kinds of information, all intended to help a manager ("decisionmaker") to act.[19] Third, systems analysis is problem oriented:

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[17] E. S. Quade, "Introduction," in E. S. Quade and W. I. Boucher (eds.), Systems Analysis and Policy Planning: Applications in Defense (New York: American Elsevier, 1968), p. 2. (Italics in the original.)

[18] That this distinction has a practical significance is illustrated by the fact that novice systems analysts, no matter how well trained academically, often find it difficult to discover where and how to begin their first independent work on a real-world problem. (The same is often true, of course, among novice futures researchers--including some who are experienced in systems analysis.) Colloquially, however, the distinction is constantly blurred, though not denied.

[19] Needless to say, analyst and manager can be the same person (or the same group). We can and sometimes do adopt a systems approach in generating our own policies, individually or collectively, as we seek to mollify our fate, enlarge our freedom, ensure our legacy, and "manage" our lesser affairs. But in the ordinary life of organizations and of society, analyst and manager are usually not the same. Indeed, it is frequently the case that policy-making is complicated or essentially blocked because the responsibility for one function or the other (or both) is too diffuse.

the only occasion for analysis is the recognition--perhaps tentative--of an existing or potential situation that may require action. Fourth, while systems analysis attempts to be as rigorous as possible in methodology, it is pragmatically oriented: analysis is impossible without the conscious use of models of one kind or another, but the models chosen should be "appropriate" to the problem and should take account of "judgment and intuition." Fifth, systems analysis is futures oriented: as remarked earlier, decisions necessarily imply forecasts; additionally, to investigate the "full problem" is to see it and a range of alternative solutions in their substantive richness and complexity through time.

Now, if "futures research" is substituted for "systems analysis" in these five points, or in Quade's definition as a whole, we seem to have a good general statement of the major attributes mentioned by most futures researchers themselves in defining their occupation.[20] Futures research, they have said, is a new way of looking at the future (a new "approach"); it is a practical enterprise that focuses on effecting change (the invention and assessment of actionable policies); it cannot and does not tackle the future in its infinite possibilities, but rather suboptimizes to the level of the possibilities surrounding the usefully pursued difficulty (the study of problems); its techniques are varied and the choice of one over another is determined in large part by the nature of the problem (pragmatism in methodology); and in forecasting and evaluating a

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[20] For reasons considered at length in Chapter 14, this conclusion holds only for practitioners outside of the Communist orbit. While increasingly becoming enamored of Western-style systems analysis, the Communists define, practice, and rationalize "prognostics" in a manner that is still unique to them.

spectrum of alternatives relevant to the problem, it is especially concerned to carry this analysis out to the end of the future period of interest (it is futures oriented). If one grants these propositions, the question is no longer how futures research differs from other kinds of activities within the futures movement, but how it differs from systems analysis.

A wholly satisfactory answer is probably not possible, if only because it often happens that futures researchers and systems analysts who would not consider themselves to be futures researchers find themselves working on the same problems, or at least in the same areas. Thus, the differences that exist between the two may be said to exist more in degree or relative emphasis on certain activities than in kind.

As a branch of systems analysis, then, what sets futures research apart is first of all its special emphasis on making explicit the subjective impressions and "models" of reality that are shared by particular groups within society or within particular organizations and that underlie (and, in fact, often determine) the choices these groups make. If the future that ultimately materializes is likely to be shaped by a group process that involves a confused recollection of history, or an unquestioned belief about the permanence of a certain way of doing things, or a bizarre understanding of men, or a dubious set of expectations about future change, it is exceedingly important to know that. ("If we believe absurdities," said Radhakrishnan, "we shall commit atrocities.") Getting at these opinions and subjective models in so far as specific problems are concerned offers some promise of seeing more clearly the meaning of proposed actions. It also can provide a firmer basis for anticipating

what the consequences of particular actions might be, before they are taken. At the very least, eliciting this information can make it possible to understand better the possible evolution of the world of greatest interest to the group and thus to minimize, to some extent, the uncertainties that will inevitably attend major choices of developments.

Futures research not only conducts investigations in what might be called policy-oriented social psychology, but it also attempts to gather and organize other equally intangible kinds of information pertinent to decisions: the nature of potential value changes, of new patterns in the interaction of people and institutions, of the beliefs that may be held by those who will inherit the effects of our choices. A second defining feature of futures research, therefore, is that it tries to describe and forecast these matters, sometimes by synthesizing information already available in the literature, sometimes by developing and testing a model, sometimes by conducting a poll or other judgmental kind of study involving a group, sometimes by a personal conjecture on the part of the analyst. By itself, however, this information is of little value. The futures researcher makes it useful in the policy context when he interrelates it with other kinds of information--concerning, say, prospective developments forecasted by economists or technologists--for the practical purpose of synthesizing a reasonably comprehensive picture of what the world, or some aspect of it, might be like in the future if things relevant to the problem in hand continue as in the past.[21] The result is a "standard"

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[21] In an impressively candid and thoughtful discussion, Bernard Cazes remarks that earlier studies of the future suffered "from one basic fault:

or "surprise free" world, against which, again, policies can be tested.[22]

The very essence of futures research, however, lies in emphasis on the use of its social psychological data, forecasts, and special syntheses of forecasts to open the realm of choice by generating alternative futures. Such alternative futures are, in effect, variations on the standard world, and their use—as a policy-generation and assessment tool--is precisely the same. Writing in 1967, Andrew Kopkind had some very sharp criticisms of the "future-planners," as he called them.[23] His essay is still well worth reading, especially by futures researchers, but he erred when he attacked the creation of alternative futures as being, of all the activities of futures research, "the most fun, but also the least responsible." He was wrong in thinking it fun, and he was wrong in thinking it irresponsible, at least in principle. (Surely it is irresponsible if it promises too much, as has often happened. And surely it is irresponsible if the results are known to be inadequate to the particular need and the user is not warned, as has also happened more

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their authors were prophets of the future; they had no notion of how society hangs together, which elements are more susceptible to change than others, how society as a system really works. Modern future research is trying to correct this deficiency." (Cazes, "Opportunities and Pitfalls of Future-Oriented Research," in G. R. Urban (ed.), Can We Survive Our Future? [New York: St. Martin's Press, 1971], pp. 351-367; the quotation is from p. 352).

[22]For a good presentation of the concept of a "surprise-free" world, see Herman Kahn and Anthony J. Wiener, The Year 2000: A Framework for Speculation on the Next Thirty-Three Years (New York: The Macmillan Company, 1967).

[23]Andrew Kopkind, "The Future Planners," The New Republic, Vol. 156, No. 8 (February 25, 1967), pp. 19-23.

than once.) The point in principle hinges on the fact that the standard world is worth studying precisely because it seems so probable and because it is worth asking if this world, in all of its major features, is really the one we want. But this question can be posed and answered responsibly only with reference to specific, well-defined alternatives that lie within man's power, within the time frame being considered.

Of course, since some aspects of all imaginable futures are now within our power, this effort could be endless. Nevertheless, some of the possibilities, particularly those that might evolve within or around our current institutional framework, are unquestionably important candidates for analysis before committing ourselves, out of mere inertia, to the standard world. Hence, at its heart, futures research can be said to place greatest stress on developing and applying methods for sorting out the possibilities deserving close examination and helping in the work of examining them, especially through the integration of judgmental and analytic data.

On this characterization, futures research adds a distinctive and important perspective to systems analysis. But it does not replace other kinds of forecasting, whether performed inside or outside of systems analysis. Rather, it builds upon the results they can provide; it extends these results systematically into the realm of judgment; and it seeks to synthesize the whole into self-consistent and policy relevant images, highlighting possible issues, opportunities, and policy alternatives that can make a difference vis-à-vis the achievement of alternative goals.

The fragment of history which adds plausibility to the idea of subsuming futures research under systems analysis has to do with the early evolution of systems analysis.[24] As this approach began to define itself in actual experience, it was recognized that one of the most significant features of this new enterprise was its attempt to cope with what Quade, in the definition quoted earlier, calls the "full" problem. Unlike alternative approaches to problems involving decisions under uncertainty, which typically take the problems, as stated, and set about solving them, systems analysis insisted on another tack. To see problems in their entirety, in all of their dimensions, came to mean--among other things--that the analysts must be free to ask whether or not they are, in fact, problems, or the "right" problems. This meant, in turn, that the scope of any important inquiry had to be substantially broadened. In such cases, however, since no one person could possibly have all of the information required to ensure that the investigation was indeed comprehensive, systems analysis demanded a multidisciplinary outlook, an outlook that involved assembling teams of specialists from fields as diverse as engineering, economics, political science, mathematics, and philosophy.

The actual effort to bring different viewpoints to bear on the same complex problem, and to do so in such a way that key assumptions were made as explicitly as possible, soon convinced most systems analysts that at some point standard analytic techniques must fail and that judgment—

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[24] For greater detail on what follows, see in particular Bruce L. R. Smith, The RAND Corporation: Case Study of a Nonprofit Advisory Corporation (Cambridge, Mass.: Harvard University Press, 1966), and, in a less scholarly vein, Paul Dickson, Think Tanks (New York: Atheneum, 1971).

the mysterious process whereby values, attitudes, and beliefs are made to guide our expectations and preferences--must come into play, just as it must come into play in most of the established social and physical sciences.[25] Indeed, they realized that judgment had to be exercised from the very beginning, in the identification of factors, relationships, and goals that should or could be considered. As it turned out, this obvious perception about the centrality of judgment in the analysis of complex systems was to be of greater moment than anyone could have guessed then. The reason is that some analysts were dissatisfied with the conventional way of dealing with subjectivity, which at best was merely to admit its presence, warn about its possible influence, and to recommend to the decisionmaker--the user of the systems analysis--that he somehow take it into account, when and to the extent he thought it appropriate. These analysts believed that there had to be better means of deriving and incorporating judgment formally in the analysis and of communicating its influence to the policymaker. This hope led them to experiment with novel methods of eliciting, evaluating, and integrating human opinion in systems studies.

What happened as a result is not just that such techniques were devised--after all, as Dr. Johnson tells us, nothing is closed to diligence and hard work--but rather that these techniques (scenario writing is an example) immediately proved useful in an application which was only

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[25] On this essential point, see Olaf Helmer and Nicholas Rescher, "On the Epistemology of the Inexact Sciences," Management Science, Vol. 6, No. 1 (October 1959), pp. 25-52.

dimly foreseen: forecasting itself. The examination of current and past relationships or values or situations is likely to be impossible without the use of judgment; the exploration and synthesis of future states of affairs, especially as one goes farther and farther out in time, is certainly impossible without judgment. These techniques provided a way. It is hardly surprising, therefore, that the most famous of them all was instantly dubbed the Delphi technique, after the Greek oracle.

When the history of futures research is written, its origins will almost certainly be traced to these innovations in methodology—not so much because of their intrinsic merits, or even because of the truly remarkable interest they generated throughout the world as they became known, but primarily because these very innovations now form the core of the set of techniques that characterize the practice of futures research. Thus, in searching for means to grapple with "full" problems, systems analysis inadvertently but decisively transformed forecasting, making it possible (and obligatory, in many cases) to use these new opinion-gathering techniques to clarify, augment, and extend projections prepared through customary methods, such as mathematical trend extrapolation, and to obtain certain otherwise unobtainable kinds of information about the future. Thereby, it gave birth to futures research.[26]

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[26]Victor C. Ferkiss, in his admirable book, Technological Man: The Myth and the Reality (New York: George Brazillier, Inc., 1969), goes somewhat farther: "the techniques of systems analysis and the study of the future were born as twins" (p. 24).

As a distinct approach, futures research has been in the background of systems analytic work for about 25 years. It seems to have first come to the fore with the publication in 1964 of the classic study by Gordon and Helmer on the Delphi technique.[27] Four years later, to the month, the Institute for the Future--the first organization in the United States, and one of the first in the world, formed to undertake futures research full time--came into existence. Since then, the number of organizations, advocates, practitioners, and publications has multiplied at a rate approaching that of the futures movement as a whole.

Enough time has passed and enough research has now been performed to make it worthwhile to examine critically the claims and accomplishments of futures research, with a view toward assessing where the activity stands today, where it might be heading, and where further progress may be slowed or stopped entirely because of theoretical or practical difficulties. For a variety of reasons, it is particularly important to ask whether futures research has proven or can prove capable of "making forecasting less of an art and more of a science." Behind this phrase lies the possibility of recognizing futures research as a discipline--a possibility that has been mentioned more and more frequently in recent years. Much more important, however, is the further possibility of

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[27] Theodore J. Gordon and Olaf Helmer, Report on a Long-Range Forecasting Study, Paper P-2982 (Santa Monica, Calif.: The Rand Corporation, September 1964); an abridgement of this study appears as an appendix in Helmer's Social Technology (New York: Basic Books, 1966). For historical perspective, it should be noted that the first work on Delphi and associated judgmental techniques began at Rand in 1948-1949.

realizing a vision first articulated in this century by H. G. Wells:[28]

> I must confess that I believe quite firmly that an inductive knowledge of a great number of things in the future is becoming a human possibility. I believe that the time is drawing near when it will be possible to suggest a systematic exploration of the future. And you must not judge the practicability of this enterprise by the failures of the past. So far nothing has been attempted, so far no first-class mind has ever focused itself upon these issues. But suppose the laws of social and political development, for example, were given as many brains, were given as much attention, criticism and discussion as we have given to the laws of chemical combination during the last fifty years--what might we not expect?

Wells urged his readers to keep in mind the example provided by the science of geology:

> ...if it has been possible for men by picking out a number of suggestive and significant looking things in the present, by comparing them, criticizing them, and discussing them, with a perpetual insistence upon why? without any guiding tradition, and indeed in the teeth of established beliefs, to construct this amazing searchlight of inference into the remoter past--is it really, after all, such an extravagant and hopeless thing to suggest that, by seeking for operating causes instead of for fossils and by criticizing them as persistently and thoroughly as the geological record has been criticized, it may be possible to throw a searchlight of inference forward instead of backward and to attain to a knowledge of coming things as clear, as universally convincing and infinitely more important to mankind than the clear vision of the past that geology has opened to us during the nineteeth century?

His conclusion was as follows:

> I...suggest to you that, along certain lines and with certain qualifications and limitations, a working knowledge of things in the future is a possible and practicable thing.

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[28] H. G. Wells, "The Discovery of the Future," Nature, Vol. 65, No. 1684 (February 6, 1902), pp. 326-331; the following quotations are from pp. 328-329.

Despite the historically important work of individual scholars like Pitirim Sorokin, William Ogburn, and S. Colum Gilfillan,[29] the proposal implicit in Wells' conclusion was hardly noticed again until mid-century. Writing in 1946, S. Lilley was thus able to point to some of the barriers that still had to be overcome before this "science" could be achieved:

> There has been as yet no important attempt to undertake in detail the fundamental analysis that would be required to found a science of prediction. The various attempts, though often made by men expert in the scientific method, have not yet been carried out on an essentially scientific basis. The best that can be said is that they are the products of acute intuition, modified by a rational, but far from systematic, survey of the available evidence. Again, there has been nothing in the nature of a "school of prediction"--no bringing together of a suitably balanced team of scientists, technologists, historians and sociologists to give those several years of work that are essential to the foundation of any science. Nor has there been any notable development of that other and looser form of co-operation that is frequently so fruitful, in which several workers in a field publish results, criticize and comment on the work of others, and by their mutual interaction advance the science they are interested in....[Thus,] the question is: could the teamwork of many, devoted to a really scientific analysis of the causation involved in technological progress, give the sort of result that is required? Could it make possible predictions of 95 or even 99 percent accuracy on which it would be possible to take social action?[30]

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[29] See Chapter 13.

[30] S. Lilley, "Can Prediction become a Science?" in Bernard Barber and Water Hirsch (eds.), The Sociology of Science (New York: The Free Press, 1962), p. 145. In 1949, Ossip Flechtheim formally called for the creation of "futurology," a science in the modest sense of being "not so different from some of the humanities (for instance, musicology) or from the social sciences (for instance, history or political science)." See Flechtheim, "Futurology--The New Science of Probability?" in Alvin Toffler (ed.), The Futurists (New York: Random House, 1972), pp. 264-276.

All of these conditions, and others, have long been satisfied, at least in appearance, but Lilley's questions remain. Moreover, a good many additional questions have been raised and seek answers.

To provide these answers, it is first necessary to examine the present state-of-the-art of futures research, not only in methodology, but in every other dimension, as suggested by the outline on the following page. Some authorities have attempted such a review and have been dismayed by what they found. Dror, for example, has concluded that the state-of-the-art is, to put it politely, "undeveloped"; worse yet, endless repetition of accepted ideas has taken the place of real innovation:

> Careful perusal of futures studies literature and, even more so, of the proceedings of the four main international conferences,[31] leads me regretfully but unavoidably to the conclusion that the rate of innovation in futures studies, both in methodology and in substantive ideas, is on a marginally decreasing curve. Read three main books in methodology, read a dozen books of substantive ideas on the future, and look over the proceedings of the Kyoto Conference--and you have got it all!...clearly, the urgent need is for innovative work, new ideas, better methodologies, new designs, rather than for sharing and resharing what has already been shared several times over.[32]

In effect, it is one purpose of the chapters in this book to repeat Dror's analysis, but to widen it as well, so that topics like those in the outline are at least touched upon.

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[31] Oslo (1967), Kyoto (1970), Washington (1970), and Bucharest (1972).

[32] Yehezkel Dror, "A Third Look at Futures Studies," Technological Forecasting and Social Change, Vol. 5, No. 2 (1973), p. 111.

A POSSIBLE FRAMEWORK FOR EVALUATING THE STATE-OF-THE-ART IN FUTURES RESEARCH

(Six Working Categories of Interest, With Representative Types of Problems)

I. PHILOSOPHICAL AND CONCEPTUAL ISSUES

- A. Possibility of "knowing" the future
- B. The nature of time
- C. Defining "rate of change"
- D. The nature of probability
- E. Futures research as a science
- F. Criteria (accuracy, rationality, reproducibility, etc.)

II. SUBSTANTIVE ISSUES

- A. Subjects chosen for forecasting in the past
  - 1. Areas of most emphasis and the significance thereof
  - 2. Areas of least emphasis and the significance thereof
  - 3. Stated criteria for selection
  - 4. Possible unstated criteria (e.g., ideological differences, attitudes in particular sectors, such as academia, government, and industry)
- B. Reasons for success and failure
  - 1. In social forecasting
  - 2. In technological forecasting
  - 3. In forecasting value changes

III. METHODOLOGICAL ISSUES

- A. Possible improvements in types of methods
  - 1. Judgmental techniques (Delphi, games and simulations, polls and surveys, scenario writing, etc.)
  - 2. Quasi-judgmental and mathematical techniques (trend correlation and analysis, computer models, matrix analysis, etc.)
- B. Possible improvements in monitoring systems
- C. Problems of synthesizing forecasts from different domains

IV. PROFESSIONAL ISSUES

- A. Education and training in futures research
- B. Problems involving standards
  - 1. Ethical standards in the practice of futures research
  - 2. Publication standards (technical and popular)
- C. Relationship to, and lessons on methodology or application to be learned from, similar activities
  - 1. Established disciplines (economics, sociology, anthropology, psychology, political science, biology, etc.)
  - 2. Multidisciplinary approaches (systems analysis, operations research, management science, policy science, risk analysis, R&D planning, corporate planning, technology assessment, social indicators, value analysis, etc.)
  - 3. Other areas (the arts, parapsychology, history, etc.)
- D. Institutionalization of futures research
  - 1. Academic centers
  - 2. Nonacademic centers (industry, government, etc.)
  - 3. Professional organizations
  - 4. International centers

V. ISSUES OF COOPERATION

- A. Influences on cooperation and collaboration
  - 1. Institutional form
  - 2. Sources of support
  - 3. Political factors, domestic or international
  - 4. Ideological factors
- B. Problems of communicating research results
  - 1. Time delays
  - 2. Publication costs
  - 3. Language barriers

VI. ISSUES OF IMPLEMENTATION AND USE

- A. Problems involving use of the literature
  - 1. Dissemination systems
  - 2. Storage and retrieval systems
  - 3. Handling of proprietary, classified, or otherwise sensitive materials
  - 4. Problems of minimizing duplication of work
- B. Use of and abuse of forecasts
  - 1. In monitoring systems
  - 2. In planning systems
  - 3. In actual decisionmaking
- C. Means of improving the use of forecasts

Against this background, it is then necessary to explore the crucial issue of whether or not the strengths which are found can be enhanced and the limitations or weaknesses can be overcome. Has futures research, in whole or in part, gone as far as it can go? A second purpose of this book is to try to formulate answers to this question, to distinguish wish from reality, to discern blind spots in the perceptions of futures researchers (or the users of futures research) may have about this vocation. Symbolic of the significance of this question is the recent publication by The Rand Corporation of an analysis of the Delphi technique which concludes that "conventional Delphi is basically an unreliable and scientifically invalidated technique in principle and probably in practice"—this, just ten years after the publication of the original Gordon-Helmer report which was so influential in establishing futures research. But the author goes well beyond Delphi:

> Consumers of information on the future need far better advice and protection from contributing professionals than they have gotten to date. The future is far too important for the human species to be left to fortune tellers using new versions of old crystal balls. It is time for the oracles to move out and for science to move in.[33]

The language is harsh and the logic is flawed, but the thrust is clear. Similar ideas have been expressed elsewhere. Of the contributors to this volume, some agree, most disagree, but all of them cast further light on the issues involved.

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[33] H. Sackman, Delphi Assessment: Expert Opinion, Forecasting, and Group Process, Report R-1283-PR (Santa Monica, Calif.: The Rand Corporation, April 1974), p. 73. The preceding quotation is from p. vi.

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Finally, and most importantly, it is necessary to inquire how the changes in futures research that are in fact deemed possible and worthwhile might best be accomplished. Some of them could, of course, simply be allowed to occur; conscious specific action may not be necessary or desirable. For the rest, however, direct action of one kind or another would be required: conferences, new publications, wider dissemination of existing information, the creation of new institutions, original research, and so on. The major concern of the chapters in this book is the alternative of original research. What problems can be overcome, or best be dealt with, through new studies? What opportunities can be enhanced? Who would beneft? How? To what extent?

It has been argued by Theodore J. Gordon, and many would agree, that "futures research is an embryonic discipline, a collection of techniques and estimates, with [only] a partially unifying philosophy. [as such,] its research agenda is immense."[34] This book arose principally from an interest in testing this argument.[35] And, as will be seen, the contributors overwhelmingly concur. Literally hundreds of research projects are suggested in the pages that follow; of these, a remarkably large number are directed at the most fundamental issues facing futures research. Taken together, they define at least the beginnings of an agenda that obviously warrants prompt, thoughtful, cooperative, and sustained attention by practitioners of futures research and by other individuals and organizations that would like to extend futures research to that uttermost limit, where it can fairly be said to have confirmed or disconfirmed the possibility of knowing the future.

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[34] Theodore J. Gordon, "The Current Methods of Futures Research," in Alvin Toffler, The Futurists (New York: Random House, 1972), p. 188.

[35] In fact, the original research agenda considered during the course of preparing this volume was the list of problems offered by Gordon in the paper cited above.

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Some Methods and Techniques for Comprehensive Impact Assessment*

JOSEPH F. COATES†

ABSTRACT

The purpose of this paper is to review some methods and techniques applicable to the preparation of Environmental Impact Statements (EIS's) emphasizing and drawing upon the accumulated experience in the conduct of technology assessment studies.

Introduction

Technology assessment is a class of policy studies which systematically examines the effects on society that may occur when a technology is introduced, extended or modified with special emphasis on those consequences that are unintended, indirect, or delayed. There are six basic assumptions:

- Technology assessment is a policy tool.
- Technology assessment is likely to be iterative and part of an interlocking set of studies.
- New technological knowledge creates new ignorance.
- A major policy need is the organization of certainty and uncertainty to define effective strategies and tactics for managing any particular technology.
- More information and analysis, rather than less, promotes better decisions.
- In the long range, indirect and unanticipated effects of a technology are often more significant than the immediate or planned consequences.

Those basic points ought to be kept in mind with regard to this class of impact studies since they resolve many otherwise conflicting study strategies. As policy studies intended to influence decisionmaking and policy formulation, one may shape and define what their contents should be. Not everything relevant to the subject enters into a policy study, only those things that will lead to informing, or influencing the decision process. In my experience good studies of this comprehensive sort are almost always iterated. You do it once to understand the problem; you do it a second time to get it right; and you do it a

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third time to burnish the results. The second round is, of course, the longest, the third the briefest. It may turn out that with experience you can collapse the process. For people getting into these complex, interactive impact studies, it is my observation that a linear study plan which goes stepwise from beginning to end only once results in incomplete, unsatisfactory results. "Do the job, do the job again, and do the job a third time" works out a lot better whatever method or technique you are using.

These comprehensive or holistic new policy studies are unlike most planning which attempts to build on certainty—on what we know well. Since we are exploring the implication of new technology, the newer the technology, the more intrinsic irreducible uncertainties there will be. Technology assessments and EISs must of necessity build on both certainty and uncertainty. The useful actions that flow out of the policy study have to be premised on the organization and identification of the implications of uncertainty as well as certainty. That is new and exciting for analysts, planners and decisionmakers.

Technology assessment has been widely practiced in the executive branch in the last half dozen years and there are at least a dozen major studies and numerous minor ones which have successfully explored the widest range of impacts of a technology or project [1,2]. The National Environmental Policy Act of 1969 (Public Law 91-190) and the Environmental Impact Statements (EISs) it requires further stimulated interest in assessing long range consequences of technology. One might look at Environmental Impact Statements as partial technology assessments. Present trends suggest that court decisions may expand the requirements under that Act and make them virtually equivalent to technology assessments. This would be especially so should the courts undertake substantive as well as procedural review.

Results of a Technology Assessment

Against that background it is useful to identify some of the rich consequences which may follow from a soundly structured technology assessment. (See Fig. 1.) The action consequences of a successful technology assessment must be acknowledged early since that should influence the structure and organization of the study. It is also important to recognize them since two widely held beliefs would demean the value of assessments. On the one hand some would label technology assessment as a means of stifling needed technological advances. On the other hand it is seen by some as a new whitewash to assuage the public about the preordained.

What might happen as a result of a good impact study goes well beyond "good and bad," "do or don't" advice. For one thing it should be grist for the mill of all parties at interest, to everybody who is concerned, whether he is an advocate, a concerned lay citizen, a possible adversary or the decisionmaker. Whether or not one is impacted or influenced by the technology, one needs the intellectual grist for one's thought process and attitude formation. One should be able to think better about an issue having been exposed to an impact statement.

An assessment may identify ignorance about risks and focus research to more sharply define them. There is every reason to believe that in a new area the anticipation of consequences should come out less than certain. One could expect to identify risks and define what should be done to learn more about them, perhaps through field research or process studies to moderate the risks; or by studying alternative sub-processes or back-up processes to reduce risks. The extensive studies on the Alaska Pipeline are examples of these sorts of assessment consequences.

Another set of consequences which tends to get neglected is the identification of gaps

FIG. 1. Possible Consequences of a Successful Technology Assessment.

- Modify the project of technology to reduce disbenefits or to increase benefits.
- Define a monitoring or surveillance program with regard to the technology as it becomes operational.
- Stimulate R&D to:
  - –define risks more reliably;
  - –forestall anticipated negative effects;
  - –identify alternative methods of achieving the goal of the technology;
  - –identify feasible corrective measures for negative effects.
- Identify regulatory or other control needs.
- Encourage the legislative development of a technology into new areas to exploit anticipated benefits.
- Identify needed institutional changes or innovation.
- Provide sound inputs to all parties at interest.
- Prevent a technology from developing (an unusual but not impossible outcome).
- Identify new benefits.
- Identify intervention experiments.
- Delay the project.
- Identify partial or incremental implementation.

in institutional structures for dealing with the technology. Similarly, gaps in the regulatory apparatus for managing the technology, and even inadequacies in the law itself ought to be integrated into the thinking about impacts because these are the mechanisms by which one controls negative impacts and proliferates and encourages the positive ones.

The definition and focusing of a surveillance or a monitoring program of the natural, environmental or social consequences of technology may result from an assessment. In many cases we do not know what is going to happen in this, that, or the other major area of impact because by the nature of the case we quickly reach the limits of theoretical and empirical knowledge. Monitoring or surveillance programs are usually extremely expensive. Therefore, an impact study can focus on where to look for effects. Another consequence might be to identify a step-wise approach to implementation. Obviously, it does not make sense to build a rail line in quarter mile stretches, but there are other classes of technologies that can be approached on a partial, piecemeal, step-by-step or modular basis. Further development can then build on experience. If you are going to build thirty nuclear power plants, maybe they should be built on the basis of impact statements with a view to generating better knowledge about impacts as well as for engineering design data for future power plants. If you are timber cutting in a certain

kind of terrain, perhaps the way to approach it is on an incremental basis to learn what the various effects of different timber cutting strategies are in that environment.

It is extremely important to look at the output side of the impact study process because the output, what people are going to do with the impact statements, should strongly influence the inputs into the study. If you do not consider the possibility of surveillance and monitoring as an output then you will never organize the study to focus on what sort of things should be subjects for surveillance and monitoring. If you never consider whether regulation is adequate, you will never put the pieces into the study that will allow you to identify the regulatory gaps. If you never entertain the possibility of an incremental approach, then you will never shape the impact study with the considerations that will allow you to find an incremental approach to the technology.

Holistic Thinking As An Art Form

Comprehensive impact or assessment studies are a class of holistic studies which attempt in some sense to embrace everything that is important with regard to a technology. It may be everything happening to the environment, or it may be everything happening to American society depending on whether we are talking about 102 statements [EISs] or technology assessments. One characteristic of holistic thinking is that we do not know how to do it routinely; secondly, it almost certainly cannot be done routinely; and thirdly, it is not a scientific or an engineering or a disciplinary enterprise. It is essentially an art form. You may or may not have the talent for it, but in any case you learn by doing. As you learn to critique art through experience, you learn to use an assessment through experience. You can't be a critic of primitive African art if you are never exposed to African art. You can not critique a primitive like Rousseau if you have never been exposed to that genre. In the same way that tastes and sensitivities build, experience as a critic builds with exposure. In the same way, the first time that you pick up the paint brush, no matter how talented you are, you are not going to come out like Michaelangelo at age forty. Even Michaelangelo had to work up to being age forty. The art element of holistic studies ought not be lost sight of. There are components that are technical; there are components that are disciplinary; but there are also components that are inventive and that are creative. And it is that art form aspect of assessment, which causes much difficulty for those driven to look for routine methods.

Components of A Technology Assessment

Several things need to be said about how technology assessment relates to the established disciplines. Put in the negative, technology assessment is not a branch of engineering nor it is a division of economics nor a part of political science, nor a branch of law nor a new thrust in operations research. While any particular study may draw upon one or more of these traditional disciplines technology assessment is different and distinct from each of these.

The second point to be made is that there is a general desire to identify the methodology associated with any problem, since the hope is that once there is a fixed methodology, it can be taught and propagated and people will learn to use it in the way they learn multiplication tables, calculus, input-output analysis and other methodological tools. The techniques and methods brought to bear in an assessment are to a substantial degree a function of (a) the problem, (b) for whom the assessment is being made, namely the organization or institution with the authority to act, and (c) the budget available for the study. While technology assessment is more an art form which must be actively

created and framed to fit the individual issue or problem being assessed, there is a relatively definable set of categories, components, or modules, what one might call a meta-methodology, which must be satisfied in a comprehensive technology assessment. These categories can be enumerated fairly straightforwardly. (See Fig. 2.)

(a) Definition of the problem, the technology, issue or project to be assessed. The client or user of a technology assessment is likely to be unclear as to what the problem is. Even the initial framing of the problem may require close examination and reworking in order to put it in a proper form to permit a useful study with a decision-related output.

(b) Definition of alternative systems to be examined. Rarely is a technology or even a major project confined to one option. There are usually a variety of systems alternatives which must be considered. For analytical purposes one may want to select a subset of technological alternatives because it may only be necessary to examine a subset in terms of impacts and consequences.

(c) The unfolding of impacts. The identification of impacts requires a combination of experience, skills, imagination, and creativity. There literally are no complete models, paradigms, or algorithms by which one can identify the consequences of a given technology. In some cases the technology itself may suggest where to look for impacts. For example, with a weather modification technology the physical system suggests to a first approximation where one would look for effects. In some cases the technology may be so diffuse, as with a picture telephone or a medical innovation, that one must go to one or another method of exhaustion to identify impacts.

(d) Evaluation of the significance of impacts. Many qualitative and quantitative tools may be brought to bear here, including tools of economic analysis, social surveys, scaling techniques, and others, but one can expect that the evaluation is likely to be a mixed bag of relatively hard and soft outputs.

(e) The decision apparatus relevant to the problem should be identified explicitly and the range of responsibilities of individual components defined as far as is feasible. With many complex problems there are overlapping and partial responsibilities in government, and in the private sector. Frequently multinational or international organizations have some responsibility for a technology.

(f) Defining decision options and alternatives open to the decision apparatus is something of a creative enterprise. It is relatively unusual for much imagination to be brought to the management of technology. One must attempt to innovate with regard to action options and alternatives and to relate to the apparatus at hand. The failure to do this often leads to vague, uncertain or inoperable options and conclusions or to wishbook

FIG. 2. Components of a Comprehensive Technology Assessment.

1. Examine problem statements.
2. Specify systems alternatives.
3. Identify possible impacts.
4. Evaluate impacts.
5. Identify the decision apparatus.
6. Identify action options for decision apparatus.
7. Identify parties at interest.
8. Identify macro system alternatives (other routes to goal).
9. Identify exogenous variables or events possibly having an effect on 1–8.
10. Conclusions (and recommendations).

recommendations while overlooking important opportunities for social invention and innovation.

(g) One must examine all the above to come to some set of conclusions, possibly to some recommendations. In general, it is best not to come to a precise and definitive single set of recommendations. A menu of alternatives and an analysis of the consequences is better fare for the decisionmaker.

In addition to the above study elements, other considerations which cut across categories and should be considered are:

(h) Parties at interest with regard to a particular technology. It is important to identify who in fact or in principle has a stake in the technology and in its possible impacts and consequences. This is important not only from an analytical view in helping identify impacts and consequences. It is also important from a decision point of view by indicating who may influence the range and kind of action options which the decisionmaker has before him. The parties at interest after all are those who will or should have the strongest influence on the decision apparatus. It is by no means simple and straightforward to identify such parties since many will come into being as groups only after the technology or the project has been implemented or is about to be implemented.

(i) Exogenous factors should have a prominent place in any technology assessment. By exogenous factors I mean those changes in society, its goals, its orientation, or its technologies which could have an influence on the primary technology or factors interacting with it. These exogenous factors may vary from another new technology itself, to an economic upturn or downturn, change in the international situation, or modification of legislation. Again, as with impacts, the identification of exogenous variables is a partially analytical and partially creative exercise.

(j) Macro technological alternatives. As part of the technology assessment it is important to recognize and analyze the impacts of variations on the technology under consideration. However, there is another set of technological alternatives which must be considered, and these are what one might call macro alternatives. For example, the various ways of removing oil from the North slope of Alaska would not comprise macro alternatives but rather systems alternatives. A macro alternative might be the development of geothermal resources, the cutting down on the demand for energy, or building superports to increase oil imports. Similarly, if one were examining alternatives to the picture telephone, the macro alternatives might involve cheaper air transportation or cable television.

These modules or components relate closely to the seven major steps in a technology assessment proposed by M. Jones then of the Mitre Corporation. Compare Figs. 2 and 3.

Methods and Techniques

Several studies have reviewed or extensively investigated the methods and techniques applied to technology assessments. In a pilot study at the Mitre Corporation for the Office of Science and Technology, Martin Jones and his associates examined five technologies and blocked out in depth the methods and approaches applicable to their assessment [3]. In the review of some 12 comprehensive technology assessments, Jones briefly noted some of the methods and techniques used and provided selective illustrations [2]. An earlier study by V. T. Coates, "The State of Technology Assessment in the Federal Government" as of 1970, reviewed some 89 studies indicating the techniques and

FIG. 3. Seven Major Steps in Making a Technology Assessment (from Ref. [3]).

Define the Assessment Task

STEP 1
- Discuss relevant issues and any major problems
- Establish scope (breadth and depth) of inquiry
- Develop project ground rules

Describe Relevant Technologies

STEP 2
- Describe major technology being assessed
- Describe other technologies supporting the major technology
- Describe technologies competitive to the major and supporting technologies

Develop State-of-Society Assumptions

STEP 3
- Identify and describe major nontechnological factors influencing the application of the relevant technologies

Identify Impact Areas

STEP 4
- Ascertain those societal characteristics that will be most influenced by the application of the assessed technology

Make Preliminary Impact Analysis

STEP 5
- Trace and integrate the process by which the assessed technology makes its societal influence felt

Identify Possible Action Options

STEP 6
- Develop and analyze various programs for obtaining maximum public advantage from the assessed technologies

Complete Impact Analysis

STEP 7
- Analyze the degree to which each action option would alter the specific societal impacts of the assessed technology discussed in Step 5

methods used [1]. Perhaps the most comprehensive and up-to-date treatment of technology assessment is the monograph prepared by Francois Hetman of the OECD [4].

It would be inappropriate in this brief paper to attempt to enumerate all the methods and techniques applicable to technology assessment, since virtually any discipline's methods may be germane to an assessment and consequently the limitless numbers of methods and techniques of all those professions may find a place in any specific study. Therefore, this paper will attempt to identify some methods thought to be less familiar to the average reader, and attempt to relate these to the ten steps outlined above and in Fig. 2.

Citizen participation is worth noting as a separate activity, since the role of the stake holders or parties at interest plays such a critical role in technology assessment, and involvement of citizens in environmental impact statements is mandated by law. Several recent books and papers more or less relate to this subject [5-7]. No attempt will be

made in this paper to be exhaustive but only to highlight some of the techniques which may be particularly noteworthy or relatively new and unfamiliar.

The basis for methods and techniques discussed in this paper is in part the references discussed above, but also more directly based on a series of completed or currently ongoing technology assessments on such subjects as airports, geothermal energy, remote sensing technology, alternative work schedules, weather modifications, automotive propulsion power systems, and others.

FUTURES TECHNIQUES

Many of the techniques applicable to comprehensive impact assessments result from forecasting and futures literature, particularly from developments of World War II. For general reviews see [8–10].

Most general systematic attempts to examine the future afford benefits which are distinct from the precision and reliability of the forecast. These heuristic and didactic benefits include: first, the demand for making assumptions explicit; second, having made the assumptions explicit, tends to promote two subsidiary benefits, namely the sharing of the explicit assumptions and the identification of divergent assumptions and the effective, conscious, systematic resolution of consequences of that divergency. An additional benefit from the systematic attempts to examine the future is almost always a broadening of the range of alternatives being considered. Complementing that is a general sensitization to complexities and interaction of factors influencing alternative futures. Finally, a more diffuse benefit is the general discipline in thinking demanded by a comprehensive, exhaustive, and systematic analysis and synthesis.

DELPHI

One of the most versatile and generally applicable of the futures techniques is consensus forecasting or the Delphi techniques as developed by Olaf Helmer, Norman Dalkey, and their associates at the Rand Corporation. The Delphi technique attempts to improve the utilization of experts in analysis, evaluation, and forecasting by using a format other than the committee meeting. Most of the drawbacks of committee operation are due to the interaction of the personalities and psychologies of the committee members. This implies that a better situation for the utilization of the experts would be a panel meeting without face-to-face confrontations, but with adequate communication and interactive feedback between the individuals involved. Note that mere elimination of face-to-face contact alone is not sufficient.

In its simplest form the Delphi technique is a carefully designed series of individual interrogations (usually best conducted by questionnaires) interspersed with information and opinion feedback. Consider the following simple illustration. Let us ask a group of eleven (for example) experts the following question: Estimate the year by which the unemployment rate among U.S. blacks will be the same as that among the white population.

First Round: The control (review, collocation) group distributes the question to the eleven respondents and received the following replies, arranged chronologically: 1972, 1974, 1975,| 1978, 1982, 1984,| 1989, 1993, 1995,| 2000, 2005

Q_1 M=1984 Q_2

Second Round: A distribution summary consisting of the mean value and the interquartile range (Q_1–Q_2 1975–1995) is put together by the review committee and

distributed to the respondents with a request for possible revisions in their individual answers. If a respondent's estimate (first or second) lies outside the interquartile range he is asked to state briefly his reasons why the answer should be higher (lower) than the 50% majority opinion given in the first round.

Thus, for instance, the man who guessed 2005 might indicate that he believes that it will take two generations to raise black educational opportunities to the point where more jobs are available, while the man who guessed 1972 might be looking toward an economic expansion following a resolution to the Vietnam war.

Third Round: The results of the second round are summarized as above and distributed. In addition, the reasons for raising (lowering) the values given in Round 2 would be documented. Then the respondents are asked to examine the new estimates and the arguments and to revise (if they choose to) their answers. Again, if an answer is given outside the second round interquartile range, documentation is requested.

The responses to Round 3 could be taken as a group consensus and dissensus. In the majority of the cases where the technique has been applied there seems to be a convergence of opinion and a narrowing of the interquartile range. In some cases polarization around more than a single "answer" has been observed. In other cases, two or even three modes or peaks may result. A panel of 10 or so people can be run by one man. As a rule of thumb, figure two hours work per panelist per complete Delphi. Expired time for Delphi depends on speed of processing answers and delays in sending them to the panel.

The Delphi technique has evolved extensively in the last few years and in general is applicable to any situation to which quantitative values may be assigned, whether these are dates, weightings, or scalings, etc. Consequently, it is applicable to almost any area of inquiry. Among the more recent developments associated with the Delphi technique is the computer-assisted Delphi in which one is able to participate over an undetermined and lengthy period. This particular development, largely the result of the work of Murray Turoff, then of the Office of Emergency Preparedness, has been described in several places [11]. Reflecting some of the difficulties associated with the Delphi technique, Theodore Gordon and his associates at the Futures Group have been moving back to a structured interview format in some cases in which the Delphi technique interviews are essentially conducted not anonymously or by mail, but in face-to-face interviews. In some sense this comprises a sophisticated variation on conversation.

The literature on the Delphi will be extensively reviewed in a forthcoming collection of readings by Harold Linstone and Murray Turoff [12]. Sackman has severely criticized the conventional Delphi against the background of survey criteria used by the American Psychological Association [13]. It is essential to note that as with any generally applicable technique Delphi is subject to certain abuse, notably the abuse of poor construction, inadequate testing, hasty and inadequate analysis, and the failure to analyze the basis for divergent opinions. It is also worth noting that the technique has been applied in a few instances to resource allocation, where again the critical feature is that the quantitative element is the resource to be allocated.

CROSS-IMPACT ANALYSIS

One disadvantage of the Delphi technique is that it tends to treat each component of the analysis as an independent variable. A more sophisticated and complex version of this technique, called cross-impact analysis, has been developed in which the individual

components of the forecast are not only independently evaluated, but evaluated in relation to each other. For example, factor *A* may have a relatively low probability of occurrence. Similarly, factor *B* may have a relatively low probability of occurrence. But the probability of factor *A* may be increased if factor *B* is realized. Cross-impact is a further development which provides a greater degree of analytical graininess. It should also be noted that the Delphi and the cross-impact techniques are in no way limited to experts, but can also be turned to exploring the different outlooks of experts and non-experts, or groups with various professional backgrounds.

TREND EXTRAPOLATION

Trend extrapolation and other futures related techniques are widely used in forecasts of all sorts and have their legitimate place in technology assessment when used as a guide to the analysis of present trends as well as a clue to what kinds of normative judgments should be made. Normative forecasting is a term used to describe goal related predictions in which the forecast is premised upon the identification of activities required to achieve a particular goal [8–10].

STRUCTURING THE PROBLEM

It is frequently the case that in attempting to unfold the impacts of a given technology, the technology itself provides a logical backbone for at least identifying first order consequences and for suggesting second and third order consequences. For example, in one study having to do with a project to increase snowfall in Colorado, the movement of the air mass which releases the snow and then continues to move downwind provides one physical system for searching out impacts. The snowfall, its evaporation, its melting, its consequent runoff into the river provides another conceptual backbone against which to search out impacts. Unfortunately, in many cases the problem does not so readily lend itself to this kind of structuring, as for example with the consequences of alternative work schedules or video-telephone or birth control technology.

In these cases, one may move to what would be called methods of exhaustion which are basically techniques based on experience which provide checklists against which one can systematically search out impacts of a technology. In the area of environmental impact statements, the U.S. Geological Survey has put forward Circular "645" which provides a one hundred by eighty-eight matrix, or some 8800 cells relating classes of effects of a technology with places in the natural or physical environment or biological world which may be effected [14]. The value in that particular approach is not in defining what is important. It provides a list of suggestions of impacts to look for. That facilitates either the experienced hand in making these analyses or the entry of novices into assessment studies. The checklist also has the advantage of being cumulative. As new effects are discovered in one area, they can be added to a general checklist and become part of a more exhaustive, systematic search. The checklist also has the advantage of facilitating presentations of results by allowing one to systematically display conclusions from a study as to where major and minor impacts may occur.

MORPHOLOGICAL ANALYSIS

Morphological analysis is another technique of exhaustive search for effects which has been extensively discussed in the literature but relatively little used except by its inventor, Fritz Zwicky, the aeronautical engineer who has used it in systematically searching for aircraft propulsion systems. The method basically depends upon asking a

series of questions about a technological development, the set of questions being exhaustive of all possible questions one could ask about the technology. One then provides a full range of all potential answers to each question. For example, with regard to planning a community health clinic, one might ask such questions as–Where could it be located? What kinds of people would it serve? What medical services would it perform?–and so on. Against each of these questions, one would then attempt to provide all conceivable answers. One then proceeds with a morphological analysis in systematically selecting all the permuted combinations of the answers to each question. Obviously, the possibilities become extremely large, but one quickly realizes that many combinations are incompatible or unrealizeable. Consequently, the total number of alternative systems to be explored indepth rapidly diminishes, but nevertheless remains quite large [15].

DECISION AND RELEVANCE TREES

Related methods of exhaustion are the decision tree and the relevance tree which attempt to develop all possible options and alternatives with regard to a technology. The branches are critical decisions which exclude other major options. See [8–10] for details.

Other methods of exhaustion particularly focused on technology assessment have been developed by Louis Mayo of George Washington University, and by Philip Bereano of Cornell University. Bereano's work particularly relates the attempt to introduce human values as a centerpiece in the conceptualization and conduct of the analysis. He has carried forth one brief unpublished analysis using this approach with regard to the Alaska Pipeline.

ECONOMIC TECHNIQUES

Virtually any technique of economics has its place in a technology assessment. Among the techniques receiving substantial use are input-output analyses which are effective as tools for tallying and organizing the interrelationships of economic activities and productivities of one sector of the economy to all other sectors of the economy, including itself. So, for example, if one sets up an input-output analysis table involving 188 sectors of the economy, and one of those sectors is the concrete and cement industry, the table would present the contributions the concrete industry makes to each of the 188 sectors of the economy, including itself. The development of this technique in the last twenty years has become a major factor in economic analysis and is now a standard tool in government [16]; it is rapidly proliferating as well in new uses such as the striking of energy balances and the application to national and international pollution issues.

The centerpiece of the application of economic techniques is cost-benefit analysis, which has been widely described in many texts. A variant on this has been called risk-benefit analysis. A National Academy of Engineering Symposium has put together a most interesting and instructive set of readings on the analysis of risks and benefits [17]. The particular issue of the value of a life is a central source of vexation in many analyses and is exemplary of a larger class of effects or consequences which are either difficult to cost out for lack of available data or which present conceptual, intellectual, and emotional obstacles to being cost analyzed as an aid to decisionmaking. With regard to the practical attempts to do this, the experience of the legal community, particularly dealing with suits for compensation and loss of life, has been pulled together in an interesting, brief monograph [18].

With regard to the more general area of effects, such as aesthetic ones which present difficulties in directly costing, Mr. Sprague of the U.S. Geological Survey has developed

an interesting technique which I call the "At Least Method." Conceptually the Sprague technique involves costing out the price of a remedy to disutility and then putting before the decisionmaker the question of whether he is willing to pay that much. If the answer, of course, is yes, that the decision system is prepared to pay that much to eliminate a disutility, then it must be worth "at least" that much. If the system is reluctant to pay that much, then the disutility is probably not worth that much.

SYSTEMS ANALYSIS

Systems analysis is a powerful tool applicable to technology assessment. As Blumstein points out, "A systems analysis focuses successively on:

1. A particular system—a collection of people, devices, and procedures intended to perform some function.
2. The function of the system—the job it is supposed to perform.
3. Measures of effectiveness by which one can measure or calculate how well alternative system designs perform the function.
4. Alternative system designs to be compared.
5. A mathematical model with which one can calculate the measures of effectiveness associated with each alternative system design." [19]

It is clear that this broadsweeping conceptual approach can be a unifying principle in any analysis. However, the emphasis on mathematical modeling, on quantitative measurings, and so forth, precludes the adequate treatment of many factors central to technology assessment such as the means by which one identifies an impact, the identification of decision apparatus, and the generation of possible options and alternatives. Of course, one could retreat to a definition of systems analysis which included all the components and permitted qualitative and judgmental analysis, in which case systems analysis perhaps becomes coincident with technology assessment.

SIMULATION

Closely related to systems analysis is the application of mathematical techniques to the simulation of a physical system. This can have a broad application in the analysis of many problems. For example, where water, meteorology, networks, traffic flows, or other readily modeled systems are a critical part of the technology, these tools can play a major part in a technology assessment.

MODELING

A more general category than simulation is modeling, which of course can include simulation. Specific mathematical modeling techniques of some general interest are dynamic modeling, which has received a recent wave of public awareness, particularly through the book *The Limits To Growth* [20], and numerous systematic criticisms [21] of that approach to the study of major policy issues. Dynamic modeling, of course, is not limited to a macro-world problem, but can be applied to any system in which a relatively small number of variables can be identified and mathematical relationships between components defined to form the basis of the computer-assisted analysis. A particular variant on this, KSIM, developed by Professor Kain with the University of British Columbia, is applicable to simulation as a didactic and heuristic tool in understanding the implications for policy of variables interacting over time. His approach is described in several publications [22].

Other examples of mathematical modeling are found in the major study underway entitled "Climatic Impact Assessment Program" which effectively is looking at the implications of fleets of supersonic aircraft on the atmosphere and ultimately on terrestrial effects. The mathematical modeling of the physical system is a principal tool in understanding the chemical and physical interactions of that total system [23].

PHYSICAL MODELING

Physical modeling, of course, can also play a part in technology assessment. For example, in a study of the proposed extension of New York City's Kennedy Jetport into Jamaica Bay, the study team took advantage of the existence of a large scale physical model of New York waterways installed at the Waterways Experiment Station in Vicksburg, Mississippi. That played a substantial part in the development of understanding of the implications of extending the Jetport [24].

SCENARIOS AND GAMES

Scenarios are mainly the attempt to systematically develop complex statements of future world states. It is a major technique for exploring future implications. Scenarios can vary all the way from brief statements of a few hundred words to very elaborate, complex, worked-out descriptions of situations with specific initial positions, attitudes, data, and orientations for parties to the scenario also specified. In the latter case, the situation is often referred to as a game. These particular kinds of "serious games" have been described in useful detail in a book under that same title by Clark Abt [25]. Scenarios and game playing have also been played with the assistance of computers and are particularly applicable to the evaluation of military hardware in simulated combat situations. Scenarios, however, may also be played out in a playacting mode in which each of the participants in the game comes forward with a position in terms of his present state-of-knowledge. These positions, actions, and so forth are all collected by "central," and the new state of the game is put forward in the next round of the game playing.

Some have even gone so far as to suggest that psycho-drama may be a useful tool for some assessment purposes. While generally serious games of the strategic sort are of very limited value as research tools, they do have substantial value as educational devices and in sensitizing the interested player to some of the complexities of the situations he will be dealing with. An interesting example of this, particularly focussing on technology assessment, is the OTA (Office of Technology Assessment) game developed by Craig Decker, a policy consultant, Washington, D.C. This is a role playing game running over several hours [26].

The author has had some interesting experiences in sensitizing groups to the complexities and conceptual approaches to technology assessment by game playing with groups of twenty to a hundred people, particularly game playing out the first day of work at a think tank which is planning a major year-long project on a technology assessment on a specific subject. The first day at work comprises a good two-hour game, playing out defining the issues to be investigated, methods, techniques, approaches, and so forth.

MOOT COURTS

Moot courts have been applied with regard to several technologies as a way of better understanding and anticipating the kinds of issues and perspectives that would be developed in a real hearing or court situation. This comprises, of course, a variation on the serious game.

PARTICIPATION TECHNIQUES AND TECHNOLOGIES

The need to bring in parties at interest, stake holders, diverse points of view, as well as to effectively involve decisionmakers and those directly influencing them in understanding the complexities and subtleties of a technology is central to the development of an effective public policy. A wide variety of techniques, particularly exploiting growing communications capability in cable TV, computers and various telecommunications hook-ups, has been described in substantial detail by Day [27], Carroll [28], Pool [29], and Etzioni [30].

Related to these participation techniques is what one might call a variety of sensitization techniques in which the principal value is to bring about mind changing to broaden the participants' outlook on the complexity of the problem and the need to bring in new issues. Coming out of the work in the futures area such techniques as Syncon would fall in the category of sensitization [31].

SURVEY TECHNIQUES

Obviously, survey techniques are a central tool in understanding public views on many issues. Technology for surveys is continually evolving. For example, Scoville [32] and Sheridan [33] have both worked with citizen participation, particularly relying on citizen polling and feedback systems. The work of Sheridan relies quite heavily on telecommunications technology. Closely related to this is the project "Minerva" of Amitai Etzioni and his associates in New York, again involving citizen interaction and feedback on telecommunications systems [30].

Other variants on techniques having general applicability to citizen participation involve newspaper ballots. Recent innovations by Edward Corwin using a modified, punched IBM card should allow inexpensive, much more convenient citizen participation and feedback by mail to material presented on radio and television [34].

DECISION THEORY

Decision theory is a growing social technology which has a major role in technology assessment, particularly with regard to quantifying alternatives for the decisionmaker. There are numerous texts in this field [35]. One specific example with regard to the decision to seed hurricanes is conveniently available as worked out by Ron Howard and his associates [36].

SCALING

Scaling techniques should be a major input to any assessment. In general one should entertain the proposition that virtually any set of related considerations can be usefully scaled one way or another [37].

BRAINSTORMING

Brainstorming as both a structured and unstructured exercise for the free-flowing generation of ideas is central to any team activity working with a complex problem. One can play this in any of its variants with any degree of sophistication.

GRAPHICS

The application of graphics techniques in public policy decisionmaking has been reviewed in an interesting paper by William R. Ewald under the title "Graphics for

Regional Policymaking: A Preliminary Study." [5] That paper reviews some 25 projects and activities in which graphics are a central part of the policy related technology. Feinberg has made a specific study on kinostatistics, that is the attempt to use graphic and cinematographic techniques for the presentation of social data with or without the assistance of computers [6]. One can carry the application of graphics to quite elaborate extents and Ewald has described a number of "situation rooms" built on the war room model for the better understanding of policy issues.

JUDGMENT THEORY

Kenneth Hammond of the University of Colorado has done basic work on the characteristics of human judgment. Why do people judge a matter the way they do? What policies do they really follow in complex situations? Let me illustrate this work with one of his classic cases, a labor management dispute. Consider the issues in the annual negotiation. Let us say we identify the issues as A, B, C, D, E, F . . and so on. What you find experimentally is that labor may be emphasizing A, B, C, D; management may find issues C, D, E, F, and G important to them. The conflict has to do with resolving their views and hence their actions about those issues. What Hammond's extensive studies show is first that people are unable, unless helped, to identify the true weight they assign to these various components. We seem to be unable to think through that C is really very important to me and I really don't give a hoot about D or F. That's hard for people to come to. What's even harder is to realize what is important to the opposition. By a system of interrogation and regression analysis Hammond is able to assign for each side the relative weight they in fact give to each element. Having assigned those relative weights, he then finds he can do a number of interesting things. First of all, he can define a set of optimal solutions to the conflict. He can define a set of solutions faster and probably better than will come out of the dispute because he can optimize across all the weighted variables. The second thing he finds is that if he tells one side what its weightings or what both sides' weightings are, he can enormously accelerate the solution of the conflict by the participants. Hammond finds that he can train people to make better judgments faster. For example, he has a neat little game which in about thirty tries "teaches" you to be a credit manager at a bank; you learn by assigning weightings as a bank credit manager does. He calculates your correlation and you have a unique measure of your learning and so of your ability to mimic or duplicate the credit manager.

In general, in utilizing judgment theory Hammond asks people a set of questions and the questions involve different choices. By an analysis of the responses to those questions he is able to determine the weighting which you assign to each of the underlying components. For example, in the bank manager case, you're given five bits of data: the sex of the applicant, his credit rating, his actual monthly income, and what he wants to use the money for, and a fifth factor. And you just go through a case and you make a judgment: give the loan; do not give the loan. And when you've gone through a set of these, Hammond quickly analyzes (with an automated system) weights you really gave to each factor. Then you get the feedback from the experts' judgment so you can rather quickly home in on making the same kind of judgments.

As the expert, Hammond has little computer-assisted display techniques to facilitate all this. This has a lot of promise to it and it is scientifically very sound. This is an interesting bit of social technology applicable to many aspects of assessment, choice and value judgment [38].

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Summary

Accepting the elements outlined in Fig. 2 as necessary for an in depth assessment of the consequences or impacts of new technological developments and the generation of useful public policy guidance, it should be clear that there are no necessary levels of thought, professional manpower or effort which can be uniquely assigned to the assessment of a particular technology. Rather, the depth, scope and reliability of the analysis will be a function of three primary variables: the technology; the budget available for the study; and the scope of responsibility of the client. Consequently, the panoply of the conventional disciplinary tools and the more or less new and innovative techniques described above must be assembled with skill and ingenuity. The assemblage is in part a function of taste, in part a function of the comfort and inclination of the investigators, and in part a function of goals for the study. The application of any techniques has the central goal of helping to define sound public policy. The goal of technology assessment is less the conventional scientific one of nailing down the facts, or testing a theory, than it is developing a degree of public wisdom. Sound projects and programs, i.e. public action, must be based on the understanding of a constantly changing mix of certainty and uncertainty about the future.

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SOME METHODS OF FUTURES RESEARCH

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A Working Paper (WP) such as this is a preliminary contribution to the work carried out by the Institute for one of its sponsors. It does not necessarily represent the Institute's final position with regard to its subject matter; it is published at this time in order to stimulate larger public discussion about issues of policy or methodology.

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FOREWORD

Early in 1975, the staff at the Institute for the Future began a retrospective study and evaluation of the methods of futures research. Attention was focused on those methods that have been used widely at the Institute and that have proved to be effective in its own work.

The purpose of this working paper is threefold: (1) to summarize the results of this review, (2) to view futures research methods in the context of related analytical methods, and (3) to indicate in broad terms the directions which such work is likely to take in the future. The report is intended for those who are interested in a "snapshot" of futures research methods from the vantage of an institutional practitioner.

The Institute's present work in methods development and application is moving toward a more empirical and eclectic phase. More specifically, an effort is now under way to codify and organize our experience in terms of elemental processes, such as: questionnaires, interviews, role playing, scenarios, models, simulation/games, workshops/conferences, and teleconferences. The long-term objective is to search for simpler conceptual schemes for characterizing futures research methods based on a greater coherence with related analytical methods (e.g., systems analysis, operations research, evaluation research, small group research, modeling, simulation).

I. INTRODUCTION

Two definitions that best capture the essential objectives of futures research are:

- identification and organization of assumptions about the future and
- systematic exploration and improvement of the understanding of long-term consequences of developments and choices.

The emphasis in these definitions is on exploring and understanding *assumptions, perceptions, developments, and consequences.* The primary purpose of futures studies is not to predict the future--for it is essentially unpredictable--but rather to make explicit the assumptions we hold about it, to identify future alternatives, to trace the possible consequences of developments, and ultimately to try to shape and guide the future to meet our needs.

The focus of this paper is on the *methods* of futures research--on the explicit and systematic ways in which assumptions, perceptions, developments, and consequences can be structured and analyzed. *As in many other analytical fields, an understanding of the uses and limitations of modeling is the centerpiece of futures research methodology.*

A model is basically a set of organized and interrelated assumptions about a thing or a process. In our daily lives, each of us constructs and deals with models of various kinds--usually unknowingly and usually without characterizing the processes as such. In a future-oriented context, a model is a representation of assumptions and perceptions about the future. This representation can take five, nonexclusive forms:

- The representation can be a *mental* model, or a picture of a slice of reality that one carries around in his head. This image of reality may be explicit in form, but it is more frequently implicit. For this reason, such models are usually poorly defined and, in parts, inconsistent. Nevertheless, they play a large part in shaping our daily attitudes and behavior.

- When a mental model is reduced to some form of prose--converting it to a *descriptive* model--the first step has been taken in making its structure more directly accessible. Equally important, the model in this form can now become a medium of communication between individuals.

- For the more detailed analyses of the researcher, *structural* models may be used to explore and define more precisely (often quantitatively) the interrelationships among model elements or components. In these cases, a matrix, a graph, or a "tree" may be used for systematically exploring and describing element-by-element or component-by-component interactions.

- Beyond this level of detail are *dynamic* models which embody time-dependent relationships of system behavior (e.g., system dynamics);

- And *probabilistic* models, in which interactions are described in terms of probability relationships (e.g., a priori, conditional, joint).

The applicability of these modeling techniques for futures research tasks depends on the kind of information which is available. The more data we have collected and analyzed in the past about a thing or a process and the more detailed our understanding of it, then the more useful our model is likely to be as a representation of reality. We can, in fact, construct models that are extremely accurate presentations of reality for many physical processes (e.g., planetary motions); these permit us to make very accurate long-term forecasts in such cases. But for other physical processes (e.g., weather-related phenomena) and in many nonphysical areas (e.g., economic processes), our models reflect only partial understanding of system behavior.

Often, our knowledge and understanding of basic system processes is so poor that primary reliance cannot be placed on any explicit model--either for short- or long-term purposes. Such are generally the cases of social, political, and regulatory processes. Here, greater reliance may be placed--particularly for the short term--on some form of extrapolation of historical data. This extrapolation need not be linear. For example, it can be an extrapolation of an assumed growth curve or an extrapolation based on a correlation to some other quantity. The common feature here is that very little understanding of underlying processes or cause/effect relationships is necessary or implied. And for short-term forecasts in which

future conditions can be assumed to be essentially as they have been in the recent past, this can be a useful method. Examples can be drawn from such applications as market penetration of a product, growth of an industry, diffusion of an innovation, and short-term forecasts of economic indicators under fairly stable conditions. For longer-term economic, social, or political developments or for cases in which discontinuities are likely, however, extrapolation becomes progressively less applicable.

When explicit models cannot be constructed, when insufficient historical data are available, or when we are dealing with the longer term future, increasing reliance must be placed on a third method--the use of expertise or judgment. Modeling and extrapolation are not, of course, devoid of expert or judgmental inputs. But the reliance on judgment and expertise becomes far more pronounced when explicit modeling or extrapolation is inappropriate or impossible. Thus, it is a matter of degree rather than kind.

Against this background, it is possible to identify three classes of futures research methods:

- the elicitation and organization of assumptions and perceptions about developments, sometimes with the aid of modeling, but usually relying extensively on human expertise and judgment;
- the structuring of interrelationships among developments through modeling; and
- the assessment of future consequences of developments and choices through the interaction of human participants and a modeling process.

These three classes of methods are reviewed in this paper. No attempt is made to be comprehensive or exhaustive. Instead, primary attention is given to the principal methods that have been developed or applied at the Institute for the Future and that have been found to be particularly useful. Both the advantages and the limitations of each method are identified to provide guidelines for future application and further development of the techniques.

II. ELICITATION AND ORGANIZATION OF PERCEPTIONS AND ASSUMPTIONS ABOUT DEVELOPMENTS

A good starting point for studying the future is to examine the assumptions and perceptions that are held about it. Such activities are often subsumed under the rubrics of "forecasting" and "predicting"--terms that can be misleading because they tend to focus attention on single forecasts and predictions rather than on alternative futures and underlying processes of change. The systematic exploration of alternative futures at the Institute has focused primarily on the assumptions and perceptions, not of individuals, but of groups.

Increasing reliance on group judgment and expertise raises several methodological issues, including:

- the definition and selection of experts (e.g., selection criteria, number of experts, background balance);
- the elicitation of information using concepts of subjective probability (e.g., use of serial questions, cumulative and density probability functions);
- the estimation of individual expertise (e.g., use of self-rating, peer rating);
- the measurement of individual assessing ability (e.g., testing with almanac* questions); and
- the aggregation of individual responses to produce group judgment (e.g., weighting of individual responses, normalizing of response distribution).

Although explorations in these areas are by no means complete, they have already contributed significantly to improving the ways we acquire information about perceptions and assumptions or underlying processes of change. Most notable of the methods to emerge from these explorations is the Delphi.

---

*Questions for which specific true answers exist.

THE DELPHI METHOD

The Delphi method has received continuing attention and use in the past decade. Developed at The Rand Corporation by Olaf Helmer and Norman Dalkey in the late 1950s and early 1960s for scientific and technological forecasting, its use has since spread widely. In addition to its extensive use in technological forecasting, it has been applied to probe such diverse areas as economic trends, medical developments, societal change, employee benefits, educational developments, regulatory processes, and general corporate environmental factors. The Delphi technique--or variants thereof--has been used extensively in the United Kingdom, Russia, and Japan. And it has been responsible, to some extent, for the development of other related techniques (such as computer-assisted conferencing, for example).

Delphi is basically a technique for gathering and processing the judgments of a group of individuals. This technique has three basic characteristics: structured interrogation, controlled feedback of responses, and anonymity of responses.*

In a typical application of Delphi, a group of respondents is selected and a questionnaire is prepared (the "Round 1" questionnaire), posing quantitative and qualitative questions about the subject to be studied. The questionnaires are administered (or mailed) to the respondents, answered, and returned. A second questionnaire ("Round 2") is then prepared and distributed; this round includes the questions from the first round, a statistical summary of the answers to each of the questions from that round (generally the upper and lower quartiles and the median of the distribution of the responses), and possibly new questions that were suggested by previous responses and comments. The second questionnaire also provides each participant with a record of his responses to that point. Participants are then asked to respond to the questions of the second round. If a participant's response differs significantly from the group median (if, for example, a response falls outside the range defined by the upper and

*Anonymity exists at two levels: during the process, participants are not known to each other; in addition, responses are never attributed to particular respondents.

lower quartiles), then specific reasons for that position must also be provided. A third round--generally the final one--may then be prepared. It repeats most or all of the questions of Round 2, along with a summary of reasons that were offered for the relatively extreme answers given in Round 1, and possibly new questions that were suggested by the responses to the second questionnaire. The respondents are again asked to consider revising their answers in view of the group response in the second round. At this point, the views of the respondents will either have converged somewhat or the reasons why convergence is unlikely will have been documented.

Many variations are possible. Written questionnaires can be replaced by personal or computer-assisted interviews; the amount and type of information fed back to the respondents after each round can be varied; the number of rounds can be varied; and the respondents can be encouraged to introduce new questions relevant to the issues being considered.

Delphi processes may be used for a number of purposes. First, they can be used to estimate a quantity, such as the date of a technological or social development. If some convergence has occurred, in such cases the median response of the final round is generally used as the output of the inquiry. The width of the response distribution can be used as an indicator of the range of uncertainty. Second, the information generated by such processes can be used to build or refine a descriptive or structural model. In this case, the comments and the reasons for extreme answers are considered a significant part of the information collected. Third, Delphi can be used to produce and organize lists of ideas or suggestions relevant to some stated problem topic. Finally, these processes can be used as communication devices, to probe consensus, or to make differences more explicit.

As previously noted, Delphi has been used and explored extensively in the past decade, both at the Institute and elsewhere. Figures 1-4 have been reproduced from several Institute reports to illustrate the range of subject matter, the variety of formats for interrogation, and the nature of responses collected.

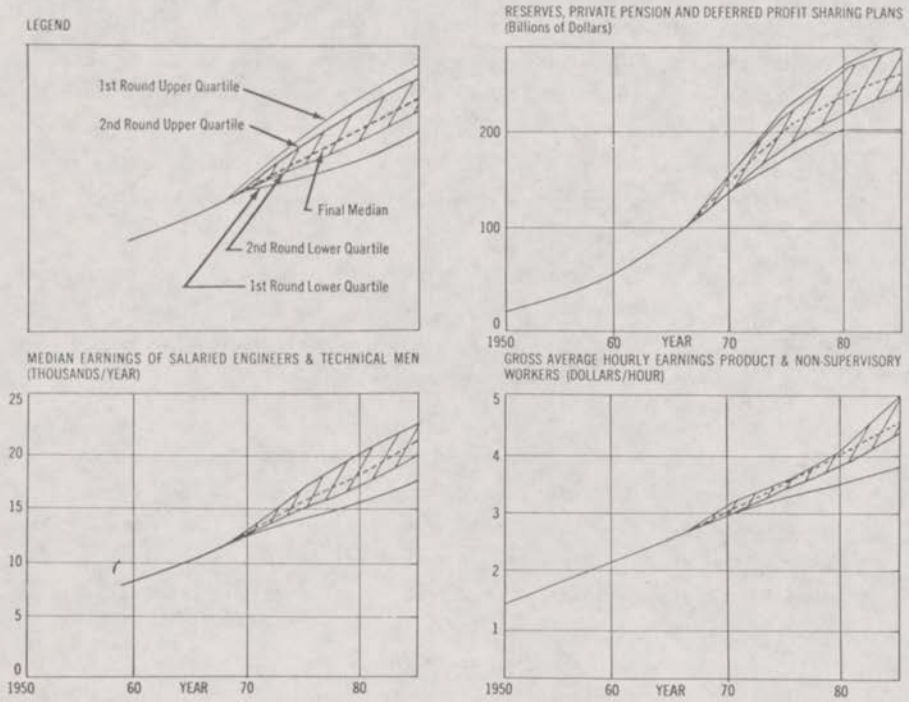


Figure 1. Example Drawn from *A Study of Potential Changes in Employee Benefits, Volume I: Summary and Conclusions*, by Theodore J. Gordon, Institute for the Future, Report R-1, April 1969

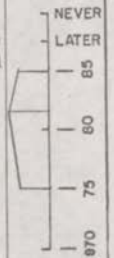
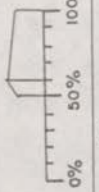
POSSIBLE CODE CHANGES	DATE BY WHICH LIKELIHOOD REACHES 50%	LIKELIHOOD BY 1985	Reasons for high and low estimates and comments are presented below.
1. There are currently four major national model building codes in wide use. These will be replaced by (or combined into) one model code.			EARLY DATE/HIGH LIKELIHOOD: - An initial attempt in this direction is already under way in that the model code organizations, along with engineering and trade associations are currently engaged in an activity directed toward achieving common definitions, code standards, and so on. This will result in a greater degree of uniformity and a clarification of substantive differences. - Government and public pressure will be directed toward building code standardization to enhance technological innovation in housing LATE DATE/LOW LIKELIHOOD: - Regional dissimilarities - Housing is not hampered by codes, but by how codes are administered and enforced. This is primarily a local political problem. - Building codes will be replaced by a new regulatory concept by 1975 (See Possible Code Change 13) - Real problems are with local modifications of model codes and difficulties associated with the introduction of innovations

Figure 2. Example Drawn from *Some Prospects for Residential Housing by 1985*, by Selwyn Enzer, Institute for the Future, Report R-13, January 1971

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CRIME

- TELEPHONE A NECESSITY FOR POOR IN HIGH CRIME AREA
  (Prob. = .81)

  Telephone becomes a necessity--even for the very poor in high crime areas because of fear. For that reason, a high percentage of the very poor will have telephones.

PROB. = .95	1*3*3*3*3*4*4*4*4*4*4*4*4*4*
PROB. = .80	3*3*3*3*4*4*4*4*4*4*4*4*4*4*
PROB. = .50	2*3*
PROB. = .20	3*4*4*4*4*
PROB. = .05	3*4*

- FEAR OF NIGHT TRAVEL INCREASES TELEPHONE USE
  (Prob. = .77)

  Significant increase in the use of telephones by citizens afraid to go out at night.

PROB. = .95	1*3*4*4*4*4*4*4*4*
PROB. = .80	3*3*3*3*3*3*3*4*4*4*4*4*4*4*4*4*4*4*
PROB. = .50	3*3*3*4*4*
PROB. = .20	2*4*4*4*4*4*
PROB. = .05	

- FAILURE OF POLICE PROTECTION IN HIGH CRIME AREAS
  (Prob. = .69)

  Inability of police to offer security for employees who must work in high crime areas.

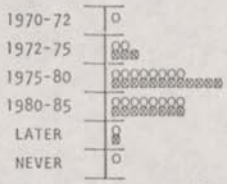
PROB. = .95	1*3*3*4*
PROB. = .80	2*3*3*3*3*3*3*4*4*4*4*4*4*4*4*4*4*4*
PROB. = .50	3*3*3*4*4*4*4*4*4*
PROB. = .20	4*4*4*4*4*4*
PROB. = .05	4*

Note: 1 = expert working knowledge
2 = quite familiar
3 = acquainted
4 = unfamiliar

Figure 3. Example Drawn from *The Future of the Telephone Industry, 1970-1985*, by Paul Baran and Andrew J. Lipinski, Institute for the Future, Report R-20, September 1971

OUTPATIENT AND INPATIENT MONITORING SYSTEMS: Automated monitoring (by most of the largest health centers) of patient symptoms through radio or wire (telephone line) transmission of heart rate, respiratory rate, and blood pressure indicators.

PANEL'S ESTIMATES OF YEAR AT WHICH LIKELIHOOD OF OCCURRENCE WILL FIRST REACH 50%



Median: 1980

O = First-round distribution
⊠ = Second-round distribution

PANEL'S MEDIAN ESTIMATES OF EARLIEST AND LATEST YEARS OF OCCURRENCE DEPENDING ON THE SOCIAL, ECONOMIC, AND POLITICAL ENVIRONMENT

As early as 1980

or

As late as 1990

SOME FACTORS FOSTERING IMPLEMENTATION ARE:

- shortage of doctors
- growth of local clinics, which can be linked to diagnosis centers; moreover, shortages of central diagnostic facilities make such organizations desirable
- success of present pilot inpatient systems
- large investment in R&D developing in this area

HOWEVER, THE IMPLEMENTATION OF THIS APPLICATION MAY DEPEND ON:

- greatly expanded allocations of radio frequencies to the private sector
- acceptance by medical profession
- automatic measuring equipment connected to memory storage
- elimination of computer downtime

AND MAY BE PRECLUDED BY:

- lack of sufficient transmission channels for patients so monitored
- relatively small number of patients requiring such close monitoring
- unavailability of radio frequency channels from FCC for outpatient monitoring

Figure 4. Example Drawn from *On the Nature of Economic Losses Arising from Computer-Based Systems in the Next Fifteen Years*, by J. R. Salancik, Theodore J. Gordon, and Neale Adams, Institute for the Future, Report R-23, March 1972

The value of Delphi must be judged in the light of goals sought and in comparison with the alternatives available to achieve those goals.* Among the most important advantages are that Delphi:

- may make it possible to obtain the collective judgment of a group of individuals without introducing psychological problems of direct group interaction (e.g., bandwagon effect) that may limit or degrade the quality of information;
- may expose real agreements and disagreements among respondents; and
- gives the investigator a simple and direct control of the scope of an investigation.

Several general problems and potential disadvantages of the Delphi technique have also been identified. Among the most significant are that Delphi:

- begins with the selection of an "expert" group--a poorly understood and undefined process;
- is susceptible to ambiguities (of questions) and biases (of investigators);
- lacks the stimulation of face-to-face exchanges;
- suppresses extreme points of view when the process is used to force consensus and may give equal weight to each expert even when it does not reach consensus;
- is open to misrepresentation due to the lack of a suitable theoretical basis for the process it employs; and
- is expensive to administer, both with respect to time and effort required.

---

*Included among the best references that contain useful critiques as well as background information on Delphi are: T. J. Gordon and Olaf Helmer, *Report on a Long-Range Forecasting Study*, The Rand Corporation, P-2982, September 1964; Norman C. Dalkey, with Daniel L. Rourke, Ralph Lewis, and David Snyder, *Studies in the Quality of Life: Delphi and Decision-Making*, Lexington, MA: Lexington Books, 1972; Klaus P. Heiss, Klaus Knorr, and Oskar Morgenstern, "Experience, Modification and Use of Delphi since 1964," in *Long Term Projections of Political and Military Power*, Mathematica, Inc., January 1973; and H. Sackman, *Delphi Assessment: Expert Opinion, Forecasting, and Group Process*, a report prepared for the United States Air Force Project RAND, The Rand Corporation, R-1283-PR, April 1974. This last reference contains one of the most complete annotated bibliographies of Delphi studies and critiques of such research.

RELATED GROUP PROCESSES

The Delphi technique can also be evaluated in comparison to several other related techniques for collecting and processing judgmental or expert information from a group. These techniques include conferences, interviews, controlled sample population polling, and computer-assisted meetings. Table 1 provides a brief comparison of the characteristics of each. The applicability of each technique can be evaluated only in terms of the information sought, the probable sources of data, the uses of the information, and time and cost considerations that reflect the value of specific information to be accumulated.

It is not uncommon to use two or more such techniques, either sequentially or in parallel. For example, among the principal variants of group processes that are increasingly being used by the Institute are the following:

- one round of questionnaires, followed by a set of personal interviews with each respondent, or the reverse of this sequence;
- a sequential set of interviews using preformatted scenarios summarizing possible future developments as a backdrop for interactive questioning;
- structured group conferences; and
- asynchronous or synchronous computer-assisted conferencing, using a commercial time-sharing network and an Institute-developed conferencing system, PLANET-1.

The relative advantages of these techniques or combinations of techniques can only be evaluated through a deeper understanding of the use of group processes in eliciting and organizing judgmental and expert information. During the past 10 years, limited efforts have been made by some investigators to explore a range of group process issues. Unfortunately, since much of this work has been based on the use of almanac-type questions and nonexpert respondents, the applicability and validity of the results may be seriously questioned vis-à-vis their relevance to the generation of alternative futures.

TABLE 1. COMPARISON OF SOME GROUP PROCESSES FOR INFORMATION ELICITATION

CHARACTERISTIC OF TECHNIQUE	ITERATIVE QUESTIONNAIRES FOR EXPERTS ONLY (E.G., DELPHI)	CONFERENCES	INTERVIEWS	CONTROLLED SAMPLE POPULATION POLLING	COMPUTER-ASSISTED MEETINGS
Normal range of number of respondents	5 to 100+ (usually <50)	3 to 100+	1 to 20+	100 to 1,000+	5 to 20+
Ability to preserve anonymity of individual opinions	Very good	Poor	Fair to good	Excellent	Very good--unrelated responses may reveal identities
Ability to explain divergence of opinion	Fair--respondents with relatively extreme opinions are asked to defend their views	Good--any participant may have his views challenged and be asked to defend them	Excellent--at the discretion of investigator	Poor	Excellent--when information is judged relevant, all new information can be questioned
Immunity to potential influence by bias of investigator	Very good	Good	Fair	Excellent	Excellent
Immunity to potential influence by bias of single participant	Very good	Fair	Good	Excellent	Good
Ability to create quantitative information in form suitable for later analysis	Excellent	Poor	Fair	Good	Excellent

TABLE 1 (Continued)

CHARACTERISTIC OF TECHNIQUE	ITERATIVE QUESTIONNAIRES FOR EXPERTS ONLY (E.G., DELPHI)	CONFERENCES	INTERVIEWS	CONTROLLED SAMPLE POPULATION POLLING	COMPUTER-ASSISTED MEETINGS
Ability of participant to express himself completely	Fair	Good	Excellent	Poor	Fair--influenced by ability of respondent to use terminal device
Freedom from location limitation	Excellent	Poor	Fair	Fair	All participants must have access to terminals
Time requirements and limitations	Often takes months per iterative round	Investigator and all participants must meet at one time and place--prearranged schedules and termination time are often constraints	Participants and interviewer generally required to be available at some time, generally during business hours	Generally limited to working hours of the investigator	Can be synchronous or asynchronous
Economy (cost) of adding additional participants	Good	Fair	Fair	Excellent	Excellent

III. STRUCTURING OF INTERRELATIONSHIPS AMONG DEVELOPMENTS

The identification of developments and their likelihood of occurrence--as provided by Delphi-like techniques--produces only a partial picture of the future. Equally important is the nature of possible interrelationships among such developments. As previously noted, detailed models can often be constructed when such relationships are known and can be made explicit. However, in most cases, such interrelationships are not known in detail (or even in general) and thus less precise modeling methods must be used for exploring and characterizing the dominant interactions.

Cross-impact modeling is a form of structural modeling that can be very useful in transforming mental images (e.g., perceptions and assumptions) of individuals or groups into a more precise form. It can also provide a valuable communication tool for the members of a group, all of whom have relevant inputs about a system structure.* The technique was developed by Olaf Helmer and Theodore Gordon in the mid-1960s as a means of examining and characterizing the dominant interactions among a set of developments. A number of variations of the basic method exist, representing a range of complexity and detail with which element interrelationships may be characterized. In the following, only the simplest forms are described in detail, although some reference is also made to the more elaborate versions of the technique.

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*Other methods have been developed to perform similar functions. (See John N. Warfield, with contributions by J. D. Hill, *An Assault on Complexity, A Battelle Monograph, No. 3*, Battelle Memorial Institute, April 1973; John N. Warfield, *Structuring Complex Systems, A Battelle Monograph, No. 4*, Battelle Memorial Institute, April 1974; and Alexander N. Christakis and David W. Malone, *A Systematic Approach to Human Settlement Planning*, The Academy for Contemporary Problems and Battelle Memorial Institute, Progress Report I of the Science-Based Planning Project, January 1974.) In particular, Warfield has developed a much more general approach to characterizing the structure of complex systems by the application and extension of the theory of binary relations.

Given a set of events,* E_1, E_2, . . . E_n, a matrix is constructed with this set of events forming both rows and columns. In the simplest case, only three general modes of interaction are assumed to be possible between pairs of events. If an event E_i occurs, then a second event E_j may be unaffected, enhanced, or inhibited. The relationships "enhancement" or "inhibition" are not well defined. They do not imply causality or any hierarchical or preferential relationship. The relationships are similar, but not necessarily identical, to increasing (enhancing) or decreasing (inhibiting) of a priori (unimpacted) probabilities of occurrence. The conditional or causal probabilities used (e.g., $p(E_i/E_j)$) are not always assumed to conform to the rules of Bayesian** statistics.***

Cross-impact interactions may initially be characterized qualitatively. Given four events and their initial estimated probabilities of occurrence:

E_1 = Price of gas will be at least \$0.90/gallon by 1 January 1977 (P_1=0.5),

E_2 = National gas rationing will be imposed by 1 January 1977 (P_2=0.2),

E_3 = National 55 mph speed limit will be retained through 1977 (P_3=0.8),

E_4 = New U.S. car sales will exceed 10 million during 1977 (P_4=0.4),

then the cross-impact matrix can be constructed as shown in Figure 5. It is also possible at this stage to include some information about the perceived intensity between event pairs by representing that intensity along an arbitrary, but nonlinear scale.

Even at this relatively simple level of detail and complexity, some extremely useful clues about interrelationships can be obtained and characterized. For example, those events that have multiple entries along a

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*Events may be defined as: occurring or not, exceeding some threshold level or not, remaining within a range or not, and so forth.

**Bayes Law states essentially that the probability of occurrence of two events is equal whatever the order of the occurrence of the two events.

***See A. Duval, E. Fontela, and A. Gabus, *DEMATEL, Innovative Methods: Report No. 1, Cross-Impact, A Handbook on Concepts and Applications*, Battelle Memorial Institute, Geneva Research Centre, 1974; and Roy C. Amara, *A Note on Cross-Impact Analysis: A Calculus for Sequence-Dependent Events*, (published in *Futures*, vol. 4, no. 3, September 1972), Institute for the Future, Paper P-22.

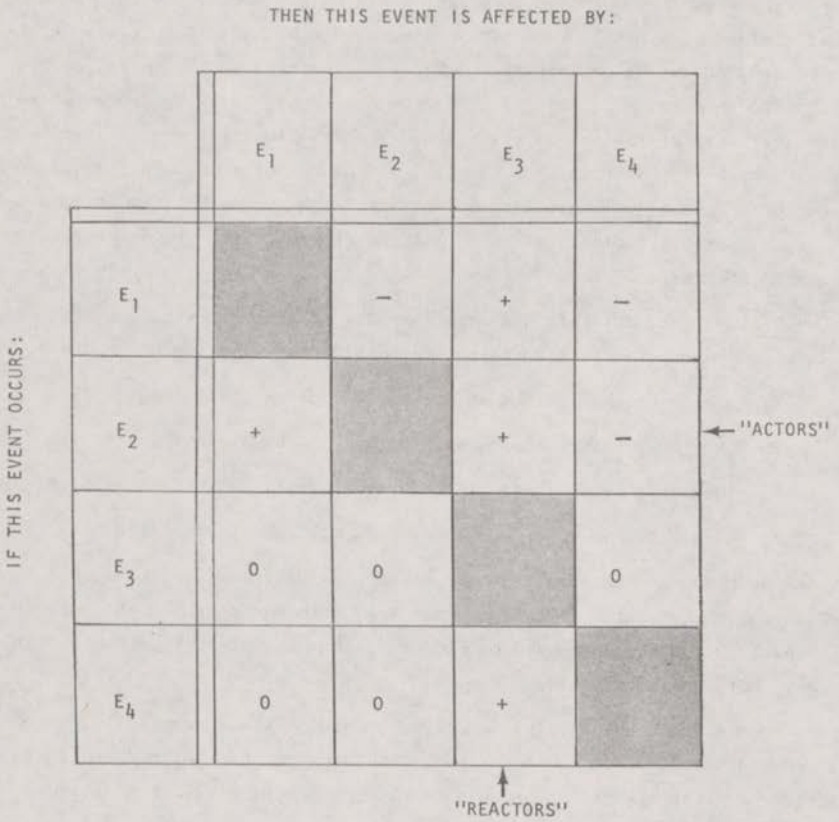


Figure 5. A Simple Cross-Impact Matrix

row are considered strong "actors"; conversely, those events that have multiple entries along columns are considered strong "reactors." Thus, E_1 and E_2 are strong actors, while E_3 is a strong reactor. These relationships may be represented in a directed graph as shown in Figure 6. In this oversimplified model, the maintenance of the national 55 mph speed limit is enhanced (initial probability increased) while the attainment of a 10 million per year sales level is inhibited (initial probability decreased).

In a much larger matrix involving many more events (20 or 30, for example), the completion of the full matrix can become long and tedious. To reduce the effort required and, at the same time, to improve the quality of the judgments that are made, several strategems may be employed.* The first is that the events may be partitioned into prespecified time intervals, such as: near term, mid-range, and long term. The second is that within each partitioned time interval, events may be divided into those that (a) occur in the same time interval but are essentially unrelated, (b) can occur only in a prespecified sequence within a time interval or across time intervals, or (c) represent alternative but competing (and therefore mutually inhibiting) possibilities. The third is to distinguish clearly those events (and trends) that are controllable (to a greater or lesser degree) from those that are not. These strategems facilitate focusing on the key event clusters without the necessity of examining an array of unrelated (i.e., "zero" entries) or weakly related combinations.

At the next level of detail, relationships between events can be specified in more precise terms. Instead of designating each cell with an enhancing or inhibiting sign or a zero, an estimate is now made of the "conditional" probabilities--$p(E_2/E_1)$, $p(E_3/E_1)$, $p(E_1/E_2)$, and so forth. As previously noted, *such probabilities do not satisfy classical Bayesian rules*. A number of empirical processes have been developed at the Institute and elsewhere for working with such probability matrices. In one form, impacted probabilities were determined through an assumed quadratic

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*Selwyn Enzer, *The Role of Futures Research on Corporate Planning*, a paper based on research done at the Institute for the Future and presented at the AAAS Annual Meeting, New York, NY, January 31, 1975.

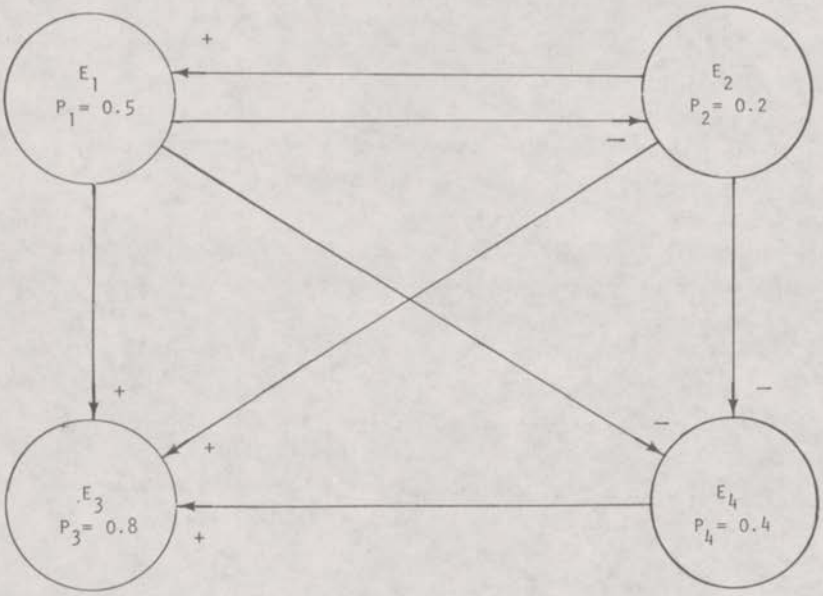


Figure 6. Graphical Representation of Cross-Impact Relationships

relationship. In a subsequent form, the impacted probabilities were determined through use of a likelihood ratio. In either case, once all entries are made in the matrix, various methods--often including Monte Carlo simulation--are employed to determine how a change in the probability of occurrence or nonoccurrence of one or more events affects the probability of other events.

Many other variations involving even more detail are possible. For example, one can consider both events and trends* jointly, now examining the possible impact of events on events, events on trends, trends on events, and trends on trends. But whatever the level of detail employed, the completed matrix entries can subsequently be used as the starting point for a more detailed description and analysis of the structure and nature of interrelationships among dominant event/trend clusters. A scanning of the matrix columns for multiple entries will identify strong reactor events or trends. Each of these may now be arrayed in "tree-like" configurations together with the corresponding sets of causal events/trends (Figure 7). And the decomposition may be traced along as many antecedent levels as seems useful.

The result of this rudimentary "sensitivity" analysis is an initial view of the dominant relationships among events/trends. This view is obtained by examining both the probabilities of occurrence of events and the perceived strengths of coupling among event/trend pairs. Clusters of key events/trends may now provide the focus for more intensive analysis, possibly by describing some relationships in more deterministic and quantitative terms using regression, system dynamics or decision-tree (probabilistic) analysis. Equally important, an analysis is now possible of possible actions for increasing the probability of occurrence of key actor events/trends on which desirable outcomes (reactor events) are dependent. Conversely, strategies or choices may also be considered that are designed to inhibit the occurrence of undesirable reactor events.

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*Events are considered singular occurrences, whereas trends are gradual developments, usually describable by a time series. Trends may not be partitioned into time intervals described previously for events, but must be analyzed for all cross impacts with each other and with all events.

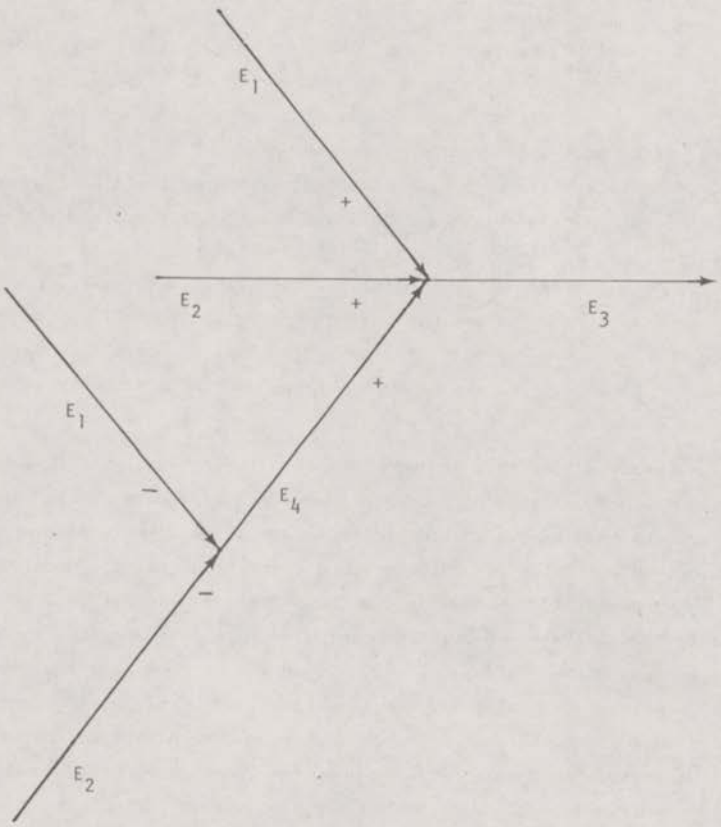


Figure 7. Tree of Cross-Impact Relationships
(See also Figure 6)

In summary, the cross-impact method, particularly in its more qualitative versions, provides a useful tool for the initial organization and structuring of interrelationships among a group of events or trends. More specifically, it can assist in:

- organizing data that describes important interrelationships;
- facilitating communication among members of a group involved in this structuring; and
- exploring strategies for achieving desired outcomes or preventing undesirable outcomes.

The principal disadvantages of the cross-impact method are:

- only interactions among event/trend pairs are considered;
- multiple accounting of probability assignments can occur because of inherent ambiguities in the nature of the interactions; and
- an adequate theoretical base for probability relationships does not exist.

IV. ASSESSMENT OF FUTURE CONSEQUENCES OF DEVELOPMENTS AND CHOICES

Of prime interest to the futures researcher is the question: How will the interaction of developments, whether characterized by a model or not, impact an individual, a group, an institution, or society in general? At least equally important is the nature of the choices that can be exercised to influence such future impacts or consequences. But models of social, political, or economic systems seldom contain enough structure or detail to provide such information directly. Even the best of our econometric models often require human intervention and interaction for "adjustment" of system parameters or coefficients, or even of the model outputs themselves. For less well defined systems, the human participant must inevitably play an increasingly interactive role in the modeling process.

Our interest here is in *gaming-simulation* as a tool for making systematic use of the judgment of participating human "players" in a variety of modeling contexts. Such players can function alternately as: decision-makers selecting alternative strategies, translators of model inputs (decisions or choices) into effects on model outputs (indicators), generators of external events, and judges of the reactive behavior of social groups to the consequences of model outputs. Gaming-simulation thus has as its central element the interaction of human players in assigned roles, conforming to some general rules of interaction.

Gordon* has identified five principal features of gaming-simulation:

1. rules of play to govern the "moves" and interactions between players and other variables of the game;

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*Theodore J. Gordon, Richard Rochberg, and Selwyn Enzer, *Research on Cross-Impact Techniques with Applications to Selected Problems in Economics, Political Science, and Technology Assessment*, Institute for the Future, Report R-12, August 1970.

2. objectives or goals, the achievement of which may include cooperative or competitive behavior;

3. a set of exogenous variables that yield external (usually probabilistic) inputs to the play of the game;

4. a procedure for translating the moves of players and the status of external inputs into effects on indicators which provide some measure of goal achievement; and

5. a method of displaying the status of play to the participants and others.

Schematically, these basic functions are interrelated as shown in Figure 8.

GAMING-SIMULATION: AN EXAMPLE

Perhaps one of the best examples of a gaming-simulation is one done by the Institute for the Future as a part of a study for the Connecticut Research Commission.* The general objective of the study was to identify and explore issues and opportunities which might arise for the State of Connecticut as a result of technological and social changes through the end of this century. The purpose of the simulation was to assess the impact of possible developments and alternative legislative programs on gross state product (GSP) and on the quality of life (QOL).

In this case, the human players were divided into three groups: a group of legislators assigned to develop programs for maximizing GSP, a second group of legislators charged with maximizing QOL, and a group of evaluators to assess the status of indicators before and after each round of play. The evaluators were, in turn, subdivided to represent various sectors of society, such as the urban poor, the middle class, older citizens, and youth.

Legislative choices were selected from a set of candidate action programs generated by a prior Institute analysis of future issues and opportunities. Each program was described in terms of its minimum budget

*Selwyn Enzer, Theodore J. Gordon, Richard Rochberg, and Robert Buchele, *A Simulation Game for the Study of State Policies*, Institute for the Future, Report R-9, September 1969.

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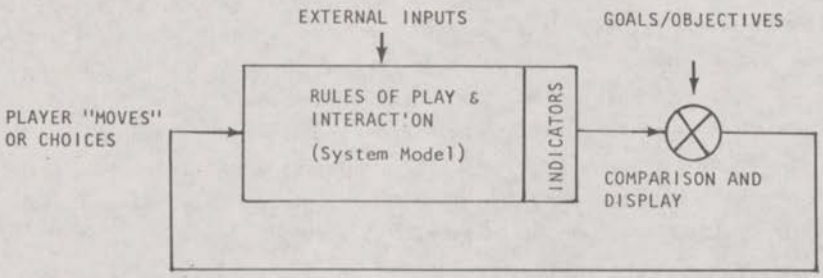


Figure 8. Basic Functions of Gaming-Simulation

level and potential impact on a set of 14 QOL indicators. Each legislative group was further constrained to a maximum overall budget for each decade (1970s, 1980s, 1990s) in which programs were put into effect. The general game flow is best illustrated in Figure 9. Table 2 shows how the indicator satisfaction levels for both GSP and QOL changed after three plays of the game.

EXTENSIONS OF GAMING-SIMULATION

The game developed in the Connecticut Research Commission study was subsequently adapted to a more general-purpose simulation STAPOL ("State Policy").* The objective was to assess the impact of government policy and technological and social developments on the QOL of a hypothetical state. A more novel extension of gaming-simulation was made in a joint project by the Institute and Battelle-Geneva** to explore the feasibility of constructing a simulation for testing national development policies for less developed countries. For this purpose, four different models--a societal gaming model, as well as demographic, socio-econometric, and events-generating models--were linked together. In the course of this simulation, human players representing various societal groups intervened at various stages of play to make strategic choices. They also participated in the generation of external events.

One of the more amibitious extensions of gaming-simulation was attempted in the structure of the Future State-of-the-Union game.*** Basically, this game represented a fairly complex socio-politico-economic

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*Dennis L. Little and Richard Feller, *STAPOL: A Simulation of the Impact of Policy, Values, and Technological and Societal Developments upon the Quality of Life*, Institute for the Future, Working Paper WP-12, October 1970.

**J. Burle de Figueiredo, A. Duval, and A. Gabus, in cooperation with S. Enzer and O. Helmer, *Blueprint of a Simulator for Testing Development Policies and National Planning*, Institut Battelle, Geneva Research Centre, January 1972.

***Olaf Helmer, *On the Future State of the Union*, Institute for the Future, Report R-27, May 1972.

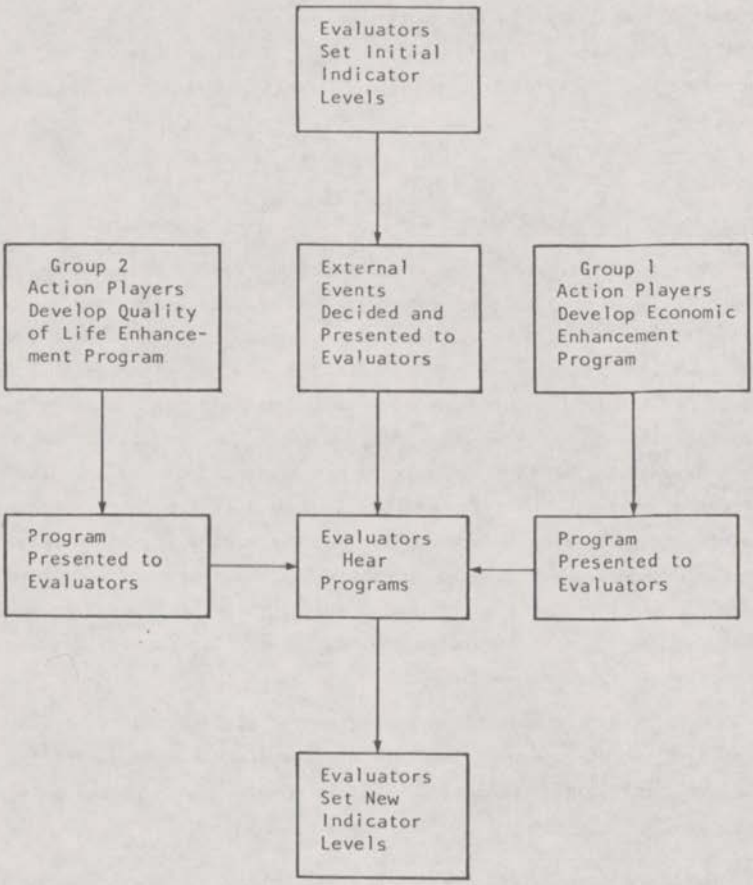


Figure 9. General Game Flow

TABLE 2. INDICATOR SATISFACTION LEVELS

INDICATOR	Initial Value (1970)	GSP TEAM				QOL TEAM			
		Changes in 1970s	1980 Value	Changes in 1980s	1990 Value	Changes in 1970s	1980 Value	Changes in 1980s	1990 Value
1. Government Effectiveness	50	6	56	4	60	4	54	5	59
2. Business Climate	70	5	75	3	78	4	74	4	78
3. Housing	50	5	55	6	61	2	52	5	57
4. Transportation	45	6	51	3	54	4	49	5	54
5. Satisfaction with Tax Structure	40	-1	39	0	39	-2	38	0	38
6. Employment	70	4	74	4	78	2	72	3	75
7. Standard of Living	65	4	69	4	73	2	67	4	71
8. Social Climate	50	4	54	2	56	1	51	4	55
9. Control of Crime	40	2	42	2	44	2	42	6	48
10. Physical Environment	65	4	69	4	73	2	67	5	72
11. Health	60	2	62	6	68	2	62	5	67
12. Education	50	6	56	6	62	4	54	4	58
13. Recreation	60	1	61	4	65	0	60	8	68
14. Personal Liberties	60	0	60	-2	58	0	60	1	61
Quality of Life	60	6	66	3	69	2	62	6	68
Gross State Product per Capita	$5000	$500	$5500	$500	$6000	$200	$5200	$600	$5800

model of the United States designed to assess the impact of a variety of forecast events and trends, as well as alternative policies and plans. The game covers a 30-year period in 10 plays of three years each, with each play impacting a set of 12 QOL indicators.*

During the past year, the Institute has begun several explorations aimed at assessing the uses of computer-assisted conferencing** in gaming-simulations. Two principal cases have been studied. The first is a simulation of a collective negotiation involving international members of the International Telegraph and Telephone Consultative Committee (CCITT). The second is a set of two social simulations involving crisis, coalition, and negotiation among six countries engaged in a game named CRISIS, developed by the Western Behavioral Sciences Institute*** (Figure 10). The data collected from these exploratory simulations have opened up some interesting possibilities for the use of this new communication medium in generating scenarios and evaluating alternative options in crisis management.

EVALUATION OF GAMING-SIMULATION

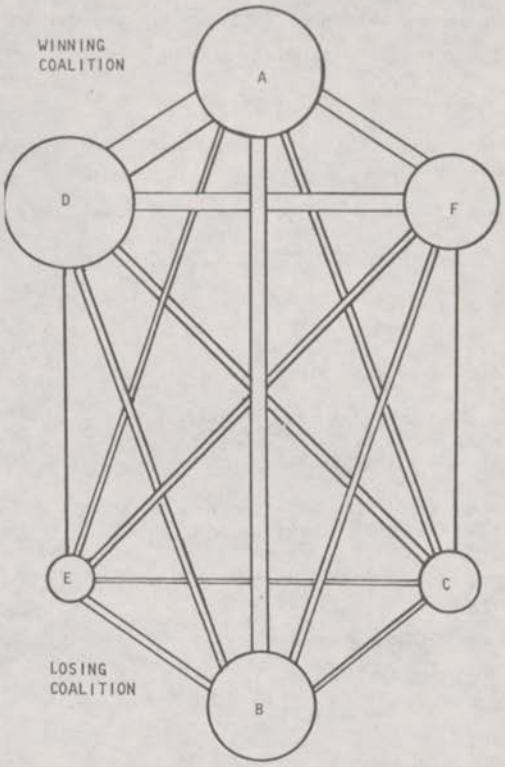
The experience of the past several years at the Institute with gaming-simulations in a variety of social contexts has identified a number of uses for this new tool. These are similar to uses now being pursued

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*Dr. Helmer has also attempted to generalize gaming-simulations for planning purposes into a series of multipurpose games. These range from passive, zero-person games, to one-person and finally two-or-more person, nonzero-sum games. Their primary purpose is educational in the broadest sense.

**Jacques Vallee, Hubert M. Lipinski, and Richard H. Miller, *Group Communication through Computers, Volume I: Design and Use of the FORUM System*, Institute for the Future, Report R-32, July 1974; and Jacques Vallee, Robert Johansen, and Robert H. Randolph and Arthur C. Hastings, Consultants, *Group Communication through Computers, Volume II: A Study of Social Effects*, Institute for the Future, Report R-33, November 1974.

***Data gathered in these simulation conferences is available by special arrangement with the Institute staff.



STRENGTH AND CHARACTERISTICS OF NATIONS

Nation	Number of Armed Forces Units	Index of Relative Overall Strength (0-20 scale)
Axiom	10.0	8.3
Burymore	10.0	10.2
Camelot	5.0	4.4
Dolchaveet	7.0	15.1
Ergosum	3.5	5.0
Fabuland	4.1	4.5

Figure 10. Communication Pattern Among Six Participating Countries (Width of communication artery between nations is proportional to the number of messages exchanged. Number in circle represents the total number of messages sent.)

elsewhere for gaming-simulation in evaluation of military strategies, in business gaming, and in conflict resolution studies. These uses include:

- exploring consequences and impacts of future developments;
- providing a vehicle for testing and evaluating alternative assumptions, choices, and strategies;
- performing sensitivity analyses of various choice options;
- generating alternative scenarios;
- serving as an educational and learning device for players in a context where real emotions may be exhibited; and
- improving communications among game players.

The principal disadvantages in the use of gaming-simulation are:

- results of gaming-simulations are generally not repeatable;
- validation of results of gaming-simulations--in a historical and future-oriented sense--is generally lacking; and
- the time and cost for conducting gaming-simulations effectively tend to be considerable.

V. CONCLUSION

The focus of this paper has been the methods developed and/or used at the Institute for the Future to explore systematically assumptions and perceptions about the future, to structure the relationships between developments, and to analyze the consequences of these developments. The tools described are basically aids to thinking about the future; as such, their utility depends critically on the skill and judgment of the user. This observation is particularly true since most futures methods are still in primitive stages of development and have limited ranges of applicability. Their principal value thus lies in helping to systematize and make explicit one's thinking about the future or, ideally, in helping to provide clues about underlying processes of change.

SELECTED INSTITUTE PUBLICATIONS

Publications of the Institute for the Future on futures research methods described in this paper include those listed below.

DELPHI AND RELATED GROUP PROCESSES

Toward Understanding the Social Impact of Computers, by Roy Amara, Report R-29, May 1974.

"Project AWARE: Societal Trends and the Corporation," *Tomorrow Begins Today*, by Roy Amara and Andrew J. Lipinski, The Chemical Marketing Research Association, November 1973.

Some Considerations Concerning Bankruptcy Reform, by Selwyn Enzer, Raul de Brigard, and Frederick D. Lazar, Report R-28, March 1973.

Computer-Assisted Expert Interrogation: A Report on Current Methods Development, by Andrew J. Lipinski, Hubert M. Lipinski, and Robert H. Randolph, Paper P-24 (originally published in *Proceedings of the International Conference on Computer Communications*, October 1972; reprinted in *Technological Forecasting and Social Change*, vol. 5, no. 1, 1973, pp. 3-18).

On the Nature of Economic Losses Arising from Computer-Based Systems in the Next Fifteen Years, by J. R. Salancik, Theodore J. Gordon, and Neale Adams, Report R-23, March 1972.

Some Prospects for Social Change by 1985 and their Impact on Time/Money Budgets, by Selwyn Enzer, Dennis L. Little, and Frederick D. Lazar, Report R-25, March 1972.

"Some Views on the Use of Expert Judgment," *Technological Forecasting and Social Change*, by Roy Amara and Andrew J. Lipinski, vol. 3, 1972.

The Future of the Telephone Industry, 1970-1985, by Paul Baran and Andrew J. Lipinski, Report R-20, September 1971.

A Forecast of the Interaction between Business and Society in the Next Five Years, by Theodore J. Gordon, Dennis L. Little, Harold L. Strudler, and Donna D. Lustgarten, Report R-21, April 1971. [out of print]

Some Prospects for Residential Housing by 1985, by Selwyn Enzer, Report R-13, January 1971.

A Study of Potential Changes in Employee Benefits, Volume I: Summary and Conclusions, by Theodore J. Gordon, Report R-1, April 1969.

CROSS-IMPACT AND RELATED MODELING PROCESSES

An Alternative Approach to General Revenue Sharing: A Needs-Based Allocation Formula, by Gregory Schmid, Hubert Lipinski, and Michael Palmer, Report R-34, June 1975.

The Role of Futures Research on Corporate Planning, by Selwyn Enzer, a paper based on research done at the Institute for the Future and presented at the AAAS Annual Meeting, New York, NY, January 31, 1975.

Note on Cross-Impact Analysis: A Calculus for Sequence-Dependent Events, by Roy C. Amara, Paper P-22 (published in *Futures*, vol. 4, no. 3, September 1972).

ederal/State Science Policy and Connecticut: A Futures Research Workshop, by Selwyn Enzer, Report R-24, October 1971.

ross-Impact Techniques in Technology Assessment, by Selwyn Enzer, Paper P-15, September 1971.

utures Research as an Aid to Government Planning in Canada: Four Workshop Demonstrations, by Selwyn Enzer, Wayne I. Boucher, and Frederick D. Lazar, Report R-22, August 1971.

Research on Cross-Impact Techniques with Applications to Selected Problems in Economics, Political Science, and Technology Assessment, by Theodore J. Gordon, Richard Rochberg, and Selwyn Enzer, Report R-12, August 1970. [out of print]

Delphi and Cross-Impact Techniques: An Effective Combination for Systematic Futures Analysis, by Selwyn Enzer, Working Paper WP-8, June 1970.

The Use of Cross-Impact Matrices for Forecasting and Planning, by Richard Rochberg, Theodore J. Gordon, and Olaf Helmer, Report R-10, April 1970. [out of print]

GAMING-SIMULATION AND RELATED SIMULATION PROCESSES

Group Communication through Computers, Volume II: A Study of Social Effects, by Jacques Vallee, Robert Johansen, and Robert H. Randolph and Arthur C. Hastings, Consultants, Report R-33, November 1974.

Group Communication through Computers, Volume I: Design and Use of the FORUM System, by Jacques Vallee, Hubert M. Lipinski, and Richard H. Miller, Report R-32, July 1974.

On the Future State of the Union, by Olaf Helmer, Report R-27, May 1972.

Multipurpose Planning Games, by Olaf Helmer, Working Paper WP-17, December 1971.

STAPOL: A Simulation of the Impact of Policy, Values, and Technological and Societal Developments upon the Quality of Life, by Dennis L. Little and Richard Feller, Working Paper WP-12, October 1970. [out of print]

Research on Cross-Impact Techniques with Applications to Selected Problems in Economics, Political Science, and Technology Assessment, by Theodore J. Gordon, Richard Rochberg, and Selwyn Enzer, Report R-12, August 1970. [out of print]

Toward the Institutionalization of Change, by Albert Wilson and Donna Wilson, Working Paper WP-11, August 1970.

A Simulation Game for the Study of State Policies, by Selwyn Enzer, Theodore J. Gordon, Richard Rochberg, and Robert Buchele, Report R-9, September 1969.

Scenarios in forecasting

René D. Zentner, Shell Oil Co.

Like their predecessors, businessmen of today wish to know what the future holds. Too sophisticated to read the entrails of animals or watch the flight of birds, the decision-makers of modern business seek a rational alternative. It is the techniques of that rational alternative that this article addresses.

In times of peace and continuity, the future is easy to understand; it is much like yesterday and today. But these are not times of peace and tranquillity. To the corporate executive and his planning staff, change never has come so swiftly, and the future never has held so many threatening signs. Corporate planners, who once were able to construct plans with reasonable assurance that those plans would be relevant to the corporate environment for at least several years, now have lost that assurance.

In times of uncertainty and change, it is probably worthwhile to give up trying to identify *the future*; the signs are contradictory, the omens ambiguous. The needs of the planner may perhaps be better served through the means of scenarios.

What are scenarios, anyway?

As business needs to address the future increased, the art of forecasting grew. Although economic forecasting may have begun with Thomas Robert Malthus' "Essay on the Principle of Population in 1798," sophisticated forecasting, and particularly theories of business cycles, developed most rapidly during and after the Great Depression of the 1930's. The 1939–45 World War, with its great proliferation of scientific methods, gave forecasters a new kit of tools, chief among them electronic calculators, advanced mathematical techniques, and game theory. Technology forecasting was an early sector of the art to take off.

Technological forecasting techniques proliferated through the 1950's and 1960's. Among the best known is the Delphi technique, developed at Rand Corp. by Olaf Helmer, Norman Dalkey, and their coworkers. Using the opinions of a panel of experts in ways designed to minimize personal persuasion and maximize convergence of views, the Delphi method recently has been extended from technological forecasting, where it arose, to social, political, and economic fields. Trend extrapolation, cross-impact analysis, and normative methods, such as morphological analysis or relevance trees, also have been developed and employed for developing forecasts.

Forecasting, supported by increasingly esoteric methods, flourished in the 1960's and early 1970's. But as forecasts proliferated, so did doubts. Forecasts are adequate and useful in periods of continuity and stability; the 1970's, with global recession, energy crises, and political upsets, were neither continuous nor stable. Forecasts have become irrelevant almost as soon as written; distrust of forecasts has become epidemic. Planners, who had employed forecasts as a kind of crutch, had their crutch taken from them. The resulting problem confronting planners was how to cope with a future about which little could be assured.

One underlying flaw in many forecasting methods lies in the assumption that the future has many of the characteristics of the present and is an extension of the trends of the

Consulting the oracle

Examination of the future has been a favorite occupation of mankind throughout history. Most cultures contain traditions by which the future was foretold through various methods of divination, astrology, crystal gazing, numerology, and the reading of playing cards or tea leaves. Chinese sages sought guidance in the ancient "I Ching," the "Book of Changes," in which 64 sets of eight symbols were shown with various interpretations. The book was used in the interpretation of patterns created by thrown sticks or wands. The skilled use of the "I Ching" was believed to provide a means not only for foretelling the future but also for controlling it.

Even such relatively sophisticated peoples as those of the Mediterranean cultures believed omens foreshadowed future events; they sought the significance of such natural phenomena as the passage of a comet or the flight of birds. Particularly perceptive forecasters were the priests of ancient Egypt. They believed that historical events followed a pattern that could be observed and from which laws could be abstracted. Thus, their observation that times of hardship and famine were followed by periods of prosperity and plenty enabled them to predict the inevitability of each kind of period from its predecessor.

It is not surprising that prophecy was a part of most world religions. The omniscient gods, who knew the future as well as the past, were consulted frequently. Unfortunately, they were difficult to address and their replies, obtained in dreams and visions, were not always unambiguous. The Greeks found it desirable to consult the gods on many occasions and did so through the institution of the oracle. In the oracle, the god actually spoke to the worshiper in reply to a human question. Oracles were fixed in a locality and each represented a particular god. Although perhaps the most famous was the oracle of Apollo at Delphi, there were numerous others. The great oracles had organizations of priests and priestesses, who interpreted their utterances. In a famous example of oracular forecasting, the Delphic oracle told Croesus that if he went to war against the Persians, he would destroy a great country. He went to war, and destroyed his own.

In ancient Rome, divination of the future was the function of the College of Augurs, which was still flourishing as late as the fourth century after Christ. Ranging in size from four to as many as 16 members, the augurs worked principally in Rome itself, advising senators, generals, and emperors. Their principal method was to ascend a hill at midnight, to survey a particular quadrant of the night sky and seek omens in shooting stars, clouds and storms, and the flight of birds. Other techniques the augurs employed included the casting of lots and the examination of the entrails of animals that had been sacrificed for the purpose.

past. Experience teaches us, of course, that this assumption is at best incomplete and is frequently plain wrong. Ian H. Wilson, who does forecasting for General Electric, crystallizes the problem when he points out, "However good our futures research may be, we shall never be able to escape from the ultimate dilemma that all of our knowledge is about the past, and all of our decisions are about the future."

And Peter Drucker, who says so many things well, says about forecasting: "We must start out with the premise that forecasting is not a respectable human activity and not worthwhile beyond the shortest of periods. Strategic planning is necessary precisely because we cannot forecast."

Econometric models of varying complexity have been employed, using electronic computers and specialized languages and programs, to generate forecasts of such variables as gross national product, inflation, housing and manufacturing growth, energy consumption, and the like. These forecasts are now in question, but if we cannot forecast, how can we plan?

One solution that has been adopted increasingly by military, government, and business planners in the U.S. and Western Europe has been to use multiple scenarios. The word "scenario" comes, of course, from the dramatic arts. It means, in the theatre, the outline of the plot of a dramatic work; in the motion picture industry, a scenario is the summary or manuscript of a photoplay, setting forth the sequence of action, the descriptions of the characters and scenes, and any other relevant details necessary to block in the plot without the extensive recitation of the actual script.

Herman Kahn, himself no mean showman, introduced the word "scenario" into the planner's vocabulary while at Rand Corp. in the 1950's. The term was used in connection with military and strategic studies conducted by Rand for the government; it appeared in the "open" literature in a book written by Kahn with his colleague Anthony Wiener, "The Year 2000," in the late 1960's in which "scenarios" were defined as: "hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision points."

By treating the future in the form of multiple scenarios, the forecaster can deal not with some particular sequence of trends and events, but with ranges thereof. Those ranges can include demographic changes, technological developments, political events, social trends, and economic variables.

Scenarios of the future take all forms, lengths, topics, and formats. A search covering only English-language business literature for the past five years turned up 33 articles discussing scenarios of the future covering such diverse topics as: the future of the actuarial profession (1), the role of management in dealing with governmental intervention (2), the seizure of Arab oil in the event of another

oil embargo (3), the handling of small-bank assets and liabilities (4), and future problems of the pulp and paper industry (5).

In the past two years, scenarios dealing with domestic and world energy problems have become among the most prevalent in the literature. In early 1974, for example, the Federal Energy Administration published its Project Independence analysis (6). The analysis comprises in large part three scenarios of the U.S. energy future and provides three different figures for U.S. energy consumption in 1985. The first scenario describes domestic energy supply and demand if the federal government took no action; in that scenario, U.S. oil imports remained high. The second describes a future in which government action is limited to energy demand restraint; the third deals with government stimulation of domestic energy supplies. In the two last cases, oil imports were reduced but with different economic and social consequences in each. The Project Independence blueprint was intended as the basis for government and public debate over U.S. energy policy; it has served that purpose admirably. Because some of the premises therein have proved at least controversial and in any event obsolete, the Federal Energy Administration has indicated that there probably will be an updated version published in late 1975.

An equally controversial set of scenarios dealing with U.S. energy policy is set forth in the final report of the Ford Foundation's Energy Policy Project (7). Like the Project Independence blueprint, the Ford Foundation study describes in detail three U.S. energy futures. An historical growth scenario deals with the consequences of U.S. energy growth at the historical 3 to 4% per year rate. A technical fix scenario describes the use of energy-saving technology to reduce the future growth rate of energy demand by half, to about 1.7% per year. Most controversial and challenging is a zero energy growth scenario, which addresses future policies that could lead to no growth in U.S. energy demand after the mid-1980's.

The six scenarios described are unidimensional; they deal principally with U.S. energy supply and demand without concerning themselves more than superficially with parallel developments in foreign and domestic political, economic, and social issues. Thus, although they are probably adequate for use in the current U.S. energy policy debate, they are too naive, coarse-grained, and mechanical to be useful as the basis for corporate planning efforts.

Various efforts also have been made to provide global insights through multiple scenarios. Most ambitious of these are the many scenarios generated by Herman Kahn and his coworkers at Hudson Institute. Daniel Bell, one of the principal sociological forecasters, also has addressed the larger issues (8). A seminal work which addresses in scenario form the global consequences of population growth, resource depletion, and pollution is "The Limits to Growth," by Dennis L. and Donella H. Meadows, which is based on examination of the future with a complex computer model employing a dynamic machine language.

Although computers and econometric or technological models have generated scenarios of the economic or technological future, the social future has not been overlooked. A provocative set of these scenarios dealing with human culture has endeavored to cope with that dimension (9). The first scenario in the set is of an improved world where people work at higher levels of consciousness by taking greater satisfaction in traditional levels of production. Replacing historical structural authority is the authority of superior knowledge, and people select whatever style of life they prefer. The second scenario is extrapolative and describes the world that will result from continuance of present trends. In that scenario, marijuana is legalized and taverns are replaced by hash inns; to cope with social problems, government becomes dictatorial. The final scenario is a counterculture hell on earth. Quality of life has deteriorated, pedestrians are shot down by casual snipers. Rehabilitation of criminals is accomplished by behavior modification. Only through recourse to a Social Management Center can people adjust to the inhuman environment. A somewhat related, though less dramatic, set of scenarios deals with the possible ways in which human labor will evolve in our society (10).

A recent set of scenarios dealing with U.S. agricultural policy has been prepared by Stanford Research Institute (11). The scenarios outline the implications for farmers, consumers, agricultural equipment suppliers, and for U.S. foreign policy. In the first scenario, U.S. farm prices are below world prices; the thrust of the scenario is to supply domestic demand. In the second scenario, U.S. agricultural production increases to satisfy both domestic and export demand; farm prices are both high and unstable because of the vagaries of world commodity markets. The third scenario shows the U.S. producing agricultural commodities to earn foreign exchange in order to deal with mineral commodity cartels. In that scenario, world demand for food is high and U.S. consumers encounter a potential decline in purchasing power, stemming from higher prices for both food and raw materials. The SRI study examines the implications of those scenarios on the relevant U.S. sectors.

From this summary, it will be seen that there is no range or topic of human activity which scenarios cannot reach. Can such scenarios be applied in the planning of the corporate enterprise?

Development of corporate planning scenarios

At the outset, it is worthwhile to divide scenarios for corporate planning into two general categories: scenarios of the environment, and scenarios of the firm. In the first category, the scenario limns for the planner the future universe that the corporation will encounter. In such scenarios, the draftsman will include exterior factors that affect the corporation. Such factors may be economic, such as the rate of inflation and the costs of labor, raw materials, or capital; or they may be political, and describe the evolution of relevant laws and regulation. The scenarios described above are principally those of the first kind, at a very macro-level of description.

The second category of scenarios deals with responses of the firm to exterior (or interior) factors. Traditionally, such scenarios have been budgetary in nature and deal with such issues as needs for capital expansion, cash flow, consequence of tax changes, and new investment opportunities. They may, of course, also deal with the possible corporate responses to technological innovation, movement into new markets, or perceived developments in consumer needs or demands. Since these scenarios tend to be highly proprietary in nature, reports of such scenarios appear less frequently in the literature (12).

In actuality, scenarios can be mixtures of these two categories. Such mixed scenarios describe both environmental changes and corporate response. Perhaps the best-known use of such mixed scenarios in corporate planning is that of General Electric, based on the work of Ian Wilson and his associates (13).

Whatever the category into which the scenarios fall, where do they come from? The following discussion derives principally from several years of scenario development at Shell Oil. It is, however, enriched from discussions with representatives of other companies, chief among them J. Kenneth Craver of Monsanto and GE's Ian Wilson, and with Prof. J. R. Bright of the University of Texas and Industrial Management Center Inc.

Organizational placement of the scenario group

It is well-established corporate dogma that forecasting and planning are staff rather than line functions. Indeed, studies by the Conference Board periodically reiterate that forecasting, generally economic forecasting, is located within the head office structure as a staff responsibility.

At Shell Oil, the roles of the planning and economics organization include forecasting, economic research, and plans coordination. The vice president of planning and economics reports to Shell's general executive office, made up of the president and executive vice presidents. The planning and economics organization orchestrates the planning process through development of corporate planning premises, by coordination of functional plans, and by review and analysis of corporate strategies. Planning is conducted by line organizations, in accordance with a framework managed by the staff group. It is within this planning and economics group that the scenarios have for the past several years been developed by the forecasting departments.

Historically, the forecasting department at Shell had developed an energy forecast for planning purposes. That forecast consisted of a detailed analysis of energy supply and demand, built up from the best economic, demographic, and political premises that could be developed. The forecast, periodically updated, was used as a planning tool by Shell's functional planners for several decades. It provided a common set of macroeconomic supply and demand parameters for all corporate planners in the development of an overall corporate strategy during the entire planning period, typically one decade.

During the period of its use, the energy forecast was a useful basis for planning. That period was characterized by stability, growth averaging about 5% a year, and gradual change in the sectors studied. But during the last years of the 1960's and the beginning of the 1970's, it became evident that change was coming faster and less predictably in all those sectors. The role of federal and state governments in energy was increasing rapidly. Environmental regulation was having a growing impact on fuel production and use. Not only were oil prices rising far faster than anticipated, but all of the factors affecting crude oil supply were changing in unexpected ways. New ways for coping with the uncertainties of the future were required by corporate planners.

In 1972, scenarios were introduced into the Shell planning process. We developed a major energy forecast and three less detailed scenarios to give to the planners, with the energy forecast to be used as a base case or planning line. We found, though, that four scenarios were too many for planners to keep track of. The following year, the old energy forecast was abandoned, to be replaced by three

The extrapolative scenario 1975 to 1990

The future evolves through a series of ad hoc compromises between conflicting public demand for protection of the environment, fuel, energy, and economic growth.

Oil remains the principal energy raw material in the noncommunist world. The marginal barrel continues to come from the Persian Gulf, through the mid-eighties, and new discoveries throughout the world and the opening up of new Soviet oil fields afford adequate crude supplies on world markets throughout the period. World crude prices continue to increase, but because of dissension within OPEC (Organization of Petroleum Exporting Countries) the increases are slow and there is no deliberate withholding of supplies. Although there is competition for crude oil among the major consuming blocs, international arrangements keep the allocation of supplies reasonably orderly. Total U.S. energy demand continues to rise at a greater rate than domestic supply, necessitating an increasing volume of oil imports.

Public recognition of the need for a trade-off between environmental conservation and energy consumption produces ad hoc accommodations between those forces. There is pressure for the government to adopt policies that permit development of energy resources, while at the same time there is opposition to environmental injury. In particular, there is continuing debate over streamlining the licensing of nuclear facilities; accelerating the easing of public oil, shale, and coal lands; and increasing domestic oil production. There is discussion of U.S. land-use policy which may ease the difficulties associated with extraction of energy raw materials and siting of energy processing facilities. There is general public acceptance of an increase in energy costs and prices not only because of the increase in the price of crude but also because of recognition of the effect of government requirements for environmental conservation (for example, reclamation of strip-mined lands, installation of stack gas scrubbers). Nevertheless, there is a public belief that government regulation of the energy industries should increase, without impairing their flexibility, growth, and competition for investment funds.

Because of the adequacy of energy supplies and concurrent environmental improvement, there is little pressure for *drastic* change in the direction of government energy policy. However, the rising cost of energy brings about some reduction in demand in some sectors.

As a result of the growth of the U.S. economy (4% per year in real terms), U.S. exports into world markets earn adequate foreign exchange to finance most U.S. imports of crude oil and refined products.

Since public pressure for change in regulatory practices is only *moderate*, the energy industries continue to attract capital, and growth continues. As new markets appear in both energy and environmental conservation areas, technology is developed by industry for those markets at a moderate rate, aided by *some* government funding where appropriate.

Because of continued expansion of the U.S. economy, individual incomes rise as energy costs increase. Individual behavior and attitudes regarding energy change slowly, and there is little awareness of changes in consumption patterns or any need therefore.

planning scenarios although it seemed to us that even three might be a lot to keep in mind.

Scenario selection and design

Assume that an enterprise has decided to employ scenarios in its planning. Furthermore, it will use the scenarios as a basis on which planners throughout the enterprise will develop a corporate plan. The scenarios will be, therefore, environmental in nature and will serve as a common set of futures that each planner can employ. Having made these assumptions, the draftsman of the scenarios will be confronted with an array of subsidiary issues.

There are, however, three principal criteria against which scenarios and their elements must be tested: credibility, utility, and intelligibility.

If the scenarios are not credible, planners will have great difficulty developing corporate strategies from them. To make the scenarios believed and accepted by planners, the draftsman must anticipate their disbelief. If the planners can be brought into the studies that are used in the scenarios, the draftsman can show them where the scenario elements come from. To the extent the draftsman can hear their reactions to those studies, he can anticipate their response to the scenarios themselves.

At Shell, we are learning the desirability of bringing the planners into the scenario process early. At the very least, they provide us with editorial support; with their comments, the construction and format of the scenarios will be tighter and clearer. We also are finding that we are receiving a lot of good ideas about the content, logic, and development of the scenarios, so that they will be more interesting and useful as well.

If the scenarios are not useful, they will be of no avail to the planners. Thus, their content must be of facts and data relevant to the problems of the planners. In an oil company, for example, future gasoline consumption is more useful than data on the progress of women's liberation.

Finally, the scenarios must be set forth in a manner easy to understand and use; no matter what their quality, if relevant information cannot be derived quickly from the scenarios, their development is in vain.

Perhaps the single biggest problem encountered in the introduction of scenarios into the planning process is that most planners, used to a one-line projection of the future, have a difficult time coming to grips with several futures. We compound the problem somewhat by emphasizing that all the scenarios have equal probabilities, so that no single scenario is to be preferred over its alternatives or is labeled "most probable."

For one thing, scenarios of the "most probable" future, even if one can be agreed upon, sound like a forecast. We wish to avoid any semblance of giving the planners such a forecast, in part because of their frustration when the future turns out not to coincide exactly with our script. Second, should we provide a "most probable" future scenario, it would be the principal scenario employed by the planners, and alternative scenarios would be dealt with in considerably less detail. Since we want the planners to address our alternative scenarios seriously, we deliberately do not prepare a "most probable" case.

Failure to do so can be very annoying to the planners, however. Their position is: These scenarios are all very interesting and provocative, but what's really going to happen? We believe that to answer that question is to seriously weaken the value of using alternative scenarios.

In principle, we expect little difficulty in planning with several scenarios. Although it is true that each requires a

different corporate strategy to deal with it, in fact the corporation must make only a limited number of major planning decisions each year. The planners must, of course, develop a plan with a variety of contingencies to cope with several scenarios.

A great deal of missionary work must be done, however, to bring home to the planners the desirability of undertaking multiple-contingency development. Part of that work consists of participating in the planning process. Although the planners have been reluctant to bring the scenario draftsmen into the process of plan development, it is evident that dialog between the two groups must be increased. In particular, the assistance and understanding of senior management will be required. Until senior management understands the scenarios and challenges plans with them, the planners probably will be hesitant to use the scenarios to their fullest extent.

How many scenarios?

The richness and complexity of the future, the extensive availability of forecasting techniques, and in particular the use of electronic computational methods make it possible to generate an infinite array of scenarios dealing with almost any topic. It is, therefore, possible to provide planners with more scenarios than they can use.

In one situation in which six future scenarios were developed, only three actually were examined and only one used by the planners. Indeed, four may be too many to keep track of unless characterized by strong, readily differentiated characteristics.

On the other hand, for planning purposes two scenarios may be too few. There is observed tendency for the users to identify them as the "good" and the "bad" scenarios. Although this polarization may be inevitable, it interferes with balanced use of each scenario. It is therefore likely that three scenarios, properly characterized, is about the right number. Note that many of the scenarios described earlier came in sets of three.

Scenario themes

One cannot discuss the number of planning scenarios without reference to other factors. Chief among these is the range and number of issues which must be dealt with by the planners. The more varied these issues and the wider their range, the greater the number of scenarios required to examine them. The selection of scenario themes therefore is one of the major problems of scenario development.

Critical scenario issues have been organized in a number of ways; matrices are, of course, popular and convenient. The literature describes many methods. In general, the scenarios employed at Shell have examined key factors involved in U.S. energy supply and demand in the light of two dominant themes. Those themes were derived by identifying the most important factors affecting corporate behavior. In recent years, such factors are government policy and economic growth. Subordinate themes include social change, energy price and availability, demographic patterns, and land use.

The term

In addition to delineating the scenario themes, the draftsman must consider the period of time to be covered. In practice, corporate planners consist of two kinds: tactical planners, who deal with the short term, and strategic planners, who deal with the long term. The meaning of short- and long-term will vary from firm to firm and industry to industry.

In general, Shell plans within a 10-year frame. For planning purposes, however, scenarios only a decade long would be inadequate. Many ventures recently begun, or soon to be initiated, would not come into fruition within that period; almost all basic research has a longer horizon. Thus, in order to respond to the needs of longer-range planners in the organization, we have chosen a term which extends out at least 15 years, currently to 1990 and in some cases beyond.

Nevertheless, we have addressed the chronological elements within the scenarios with differing degrees of magnification. The short term (1975 to 1977) is described in great detail, to suit the needs of tactical planners. The medium term, to 1985, is given in somewhat less detail. The long term, 1985 to 2000, of which we are least certain and for which the least need is felt by planners, is given in broad-brush strokes; the level of detail is considerably less than that for the preceding periods.

Format of the scenarios

It is considerably easier to deal with the length in years of the scenarios than with the length in pages. One of the most challenging problems facing the draftsman is that of packaging the scenarios for presentation and use.

We find that all scenarios must have the same length and degree of development. In 1972, when we presented a base case energy forecast developed in considerable breadth and detail and three alternative scenarios developed in much less detail, the three alternatives were ignored.

It is possible, too, to overwhelm the planners in detail. In 1973, we developed three planning scenarios of equal degree of detail and included in each all assumptions and references employed in its development. The resulting book was so thick and intimidating that almost no one read it through and understood it. Most users tended to nibble at the parts that related to them. As a consequence, the scenarios really were not very well understood and were badly used. A thin book is less daunting and more useful than a thick one.

Since most planners are more interested in data than in narrative, we have pared the recitation of premises for each scenario to an irreducible minimum and emphasized presentation of data; planners are notorious number crunchers. Readily understood charts and graphs, colored where appropriate, are preferable to endless tables, but tables are required to support the illustrations. In the course of the last several planning cycles, we have made all the appropriate mistakes and continue to strive to reduce the size and increase the comprehensibility of the scenarios. Currently, most planners receive a bound indexed scenario digest of no more than 50 pages at the beginning of each planning cycle.

For the planner who requires more detail or volume than the basic scenario digest, additional data and, if necessary, narrative can be provided. Moreover, sufficient data and computational facilities are on hand to generate subscenarios for particular planners or organizations.

Not all scenarios are necessarily as detailed or extensive as those noted. Some of the scenarios of Hudson Institute are compressed into a few paragraphs. Alternative scenarios

The energy crusade scenario 1975 to 1990

The future is dominated by a zeal for domestic energy development precipitated by severe disruption of imported energy.

Oil supply is uncertain. There are frequent supply interruptions and world crude prices escalate rapidly and unpredictably. Not only is there sporadic conflict in the Middle East but producing nations threaten to coerce consuming blocs for economic or political reasons. Competition for oil supplies among the consuming blocs becomes increasingly aggressive, and continuity of supply to any nation is uncertain. Supplies from the Soviet Union, and other "new" areas, while increasing, are inadequate to remedy matters.

Frustrated by attempts to obtain secure supplies of foreign crude oil at reasonable prices, the U.S. public presses the federal government to increase development of U.S. energy resources. In particular, the federal government is urged to accelerate its attempts to increase domestic supply and to develop new energy raw materials. Moreover, public support arises for federal taxing, licensing, and regulatory policies which favor development of U.S. energy resources and construction and operation of domestic energy facilities. Articulate spokesmen advocate that federal funding of energy research in the private and public sectors be expanded to the extent necessary. Although there are voices to the contrary, there is increasing public pressure for relaxation of environmental restrictions, although on an avowedly interim basis.

The need for energy conservation becomes more apparent, and the public hotly debates practicable and acceptable means of achieving it.

In this climate, the energy industry becomes a "glamour" industry, attracting the best managerial, technical, and scientific manpower. The same crusading, adventurous spirit that characterized the Manhattan Project and the early U.S. space programs now pervades the energy sector.

Early in the program, the inevitable accompanying energy price rises (constant dollars) are accepted in the name of continuity and security of supply. Because of the favorable government tax and profit attitudes, profits are attractive and the energy industries have no difficulty attracting capital.

Economic growth continues and is not materially inhibited by uncertainty of imported oil supplies. As the rest of the developed world is in similar energy supply straits, the U.S. international trade position vis-à-vis its industrialized competitors does not deteriorate.

employed for other purposes may run from one page each to several pages. On the other hand, the energy scenarios of the Federal Energy Administration and of the Energy Policy Project of the Ford Foundation are contained in volumes of substantial mass.

Where do the data come from?

The information employed for developing scenarios comes, of course, from the minds of the people who draft them. It is important to make clear that, at least in the Shell forecasting group, the principal purpose of the group is not to generate scenarios but to study certain aspects of the future. Indeed, the scenarios are a by-product of those studies rather than a raison d'être.

As the corporation moves inexorably into the future, it requires certain information about the nature thereof. The forecasting group, therefore, examines, by way of special studies, each of the fields in question. These studies may include:

- Economic long-term economic growth, balance of payments, energy prices and their effect on GNP.
- Social public attitudes about energy and energy companies, demographic projections and population distribution, public attitudes on western water use.
- Political U.S. energy policy, land-use planning, regulation of energy companies.
- Technological motor gasoline consumption and U.S. transportation, potential for domestic coal production, U.S. refinery capacity utilization, nuclear energy development.

In the course of these studies, we develop a great deal of information relating to ways in which scenarios addressing those topics could develop.

The data going into those studies are derived from a variety of sources. Not only does Shell have an extensive company library but we have access to public and university collections as well. Moreover, we receive and endeavor to read periodicals, reports, and books on almost every relevant topic. We attend appropriate meetings and participate in government and academic studies. For example, during the past year, representatives of the forecasting organization served on committees of the National Petroleum Council and the Texas Governor's Energy Advisory Council, and participated in several academic seminars and studies.

Where it would be more efficient to use information others have developed than to generate our own, we use consultants. Thus, in various projects we have undertaken, we have worked with professors from such universities as Harvard, Colorado, and Rice; with consulting firms such as Arthur D. Little Inc. and Stanford Research Institute; and with public opinion surveyors such as Yankelovich, Skelly & White, and Louis Harris & Associates. We also subscribe to economic data and computational services, principally Data Resources Inc. and Chase Econometrics. Each of these provides us with comprehensive banks of economic data, on-line modeling capability, and periodic economic forecasts.

Internal consistency is a necessary feature of the scenarios. In organizing the themes and the associated information going into each, it is important to make sure that the features mesh with one another. Successful scenarios are more than just a bundle of forecasts and projections; they unfold with a logic and consistency that give them credibility to the reader. Judgment and discipline in the drafting process are required to coordinate the economic features with the political, the social with the technological. To reconcile these differing forces, the requirements of consistency must be kept before the draftsman.

The group

Even with the wealth of information at hand about the past, present, and future, one must deal with the problem of weaving the facts and forecasts into the scenario tapestry. In mounting the Shell scenario program, it became evident that a considerable breadth of viewpoint and discipline would be required. At the same time, we believed that the scenario-drafting group should be kept to a small, manageable size.

The economic and social forecasting group comprises five professionals. Where possible, we drew from within the existing Shell organization. Where the skills we required were

not available within the organization we recruited them from outside.

In this fashion, we built from an economist and an attorney already within the organization. As our needs increased, we recruited from outside an engineering economist and, later, a sociologist. Technological and energy forecasting is conducted by a parallel group of mathematicians, scientists, and engineers.

Little exists in the literature about the makeup of other corporate forecasting groups. Skills required for scenario development, however, suggest the desirability of including within the social and economic group a professional with political science skills.

Techniques

A variety of techniques are available to these scenario draftsmen. These tools, plus the judgment of the individual draftsman, determine the effectiveness of the scenario design. Prominent among the methods available for scenario development is the Delphi technique, whose methods for interrogating a panel of experts and treating the resulting data can be used not only to project future events but their timing and importance.

Cross-impact analysis (*14*) also is widely used for developing scenarios from an array of events of varying probability and effect in a way so that an orderly examination of the consequences on all variables of altering any one variable can be made. This method can generate a variety of scenarios from one set of events.

The use of dynamic models continues to be an important method of scenario generation; it is best developed in the field of econometrics but Jay W. Forrester and his students at Massachusetts Institute of Technology have in recent years extended its application to other fields. Experience has shown that models are useful for gaining insights into complex processes, but their results must be interpreted with great care and professional judgment.

The use of other devices is extensively detailed in the literature. For the corporate planning group wishing to secure custom-made scenarios without the need for developing its own, a growing number of consultants are available, including Institute for the Future in Menlo Park, Calif., and Futures Group in Glastonbury, Conn. These organizations provide services delineating future significant trends and events as well as assistance in scenario design and execution. Hudson Institute of Croton-on-Hudson, N.Y., also is a fruitful source of insights and scenarios of the future.

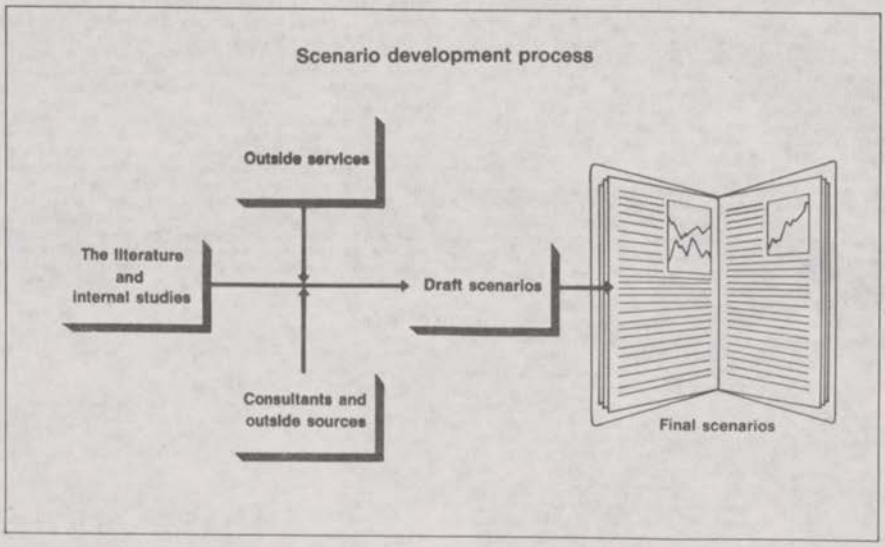
Problems of scenario use

- Introduction
  - Characteristics
  - Transition
- Scenario selection and design
  - What?
  - Who?
- Scenario presentation management acceptance
  - The audience
  - The dialogue
  - The book
- Scenario use
  - How?
  - Monitoring
  - Feedback

Use of scenarios in corporate planning

The purpose of corporate planning is to identify and examine the corporate decisions that must be made in the near future. Activities that require such decisions are organized, and their consequences analyzed, through development of corporate strategies. Corporate strategies, in turn, can be prepared by planners confronted by scenarios.

Alternative scenarios are not, however, self-executing. To be used effectively, they must be understood and accepted by the planners. It therefore is important to bring corporate staff with planning responsibilities into the conception and development of the planning scenarios at the earliest possible stage. The greater the involvement of the planners in their development, the greater the utility of the resulting scenarios in planning.



The energy limited scenario 1975 to 1990

The future is dominated by limited availability of energy imports, concern for the environment, and public attitudes opposing economic growth.

Oil remains the major energy raw material in noncommunist countries, and its principal source continues to be in the Persian Gulf. For political and economic reasons, the OPEC countries limit production, and a world crude scarcity extends through most of the period. The large consuming blocs—North America, Western Europe, and Japan—compete in world markets for the available crude oil. Crude oil prices are steadily bid up through the period.

Political forces favor "improvement in quality of life" over economic growth and urge the adoption of strong federal environmental and energy conservation policies. Vocal sectors of the public contend that the growth of the nuclear industry should be restrained; domestic oil production and leasing of oil, coal, and oil shale should be limited, and consumption of sulfur-containing fuels be severely controlled. There is growing pressure that government regulation of the energy industries be increased very *drastically*.

There is support for the view that U.S. economic growth should slow. Political pressures arise to limit federally funded development of domestic energy resources.

As demand for energy slows, the growth rate of the energy industries slows. Research in such areas as new clean energy sources, pollution control, and improved energy utilization is advocated by the public but governmental budget limitations and the slower pace of economic development keep funding to about the present level (in constant dollars).

As a result of pressure for slowing of economic growth, as well as the increasing scarcity and rising cost of energy, the public tends to become more austere in its consumption behavior. Continuing to favor the environmental conservation ethic, as part of the improvement in "quality of life," the public increasingly adopts energy-saving practices.

Once a corporate strategy is developed, the scenarios also are useful in its testing. As previously suggested, such a strategy will require examination of only a limited number of decisions within the near future. Some of these decisions will have the same consequences for each future scenario; they are therefore neutral to all scenarios. On the other hand, some decisions will have favorable consequences in some scenarios and unfavorable consequences in others. The measure of benefit or regret for such decisions thus can be estimated. The judgment of senior management will in general be invoked if these decisions are large ones. Through use of the scenarios, however, the regret of making such decisions (or not making them) can be made overt and, possibly, quantified.

For the scenario system to be useful, the scenarios must be kept current and relevant. It is therefore desirable to review and update them periodically. For example, scenarios dealing with energy supply and demand made prior to 1974 should be rerun in the light of the new world oil prices prevailing after the Arab oil embargo ended. Corporate scenarios may be too general and contain insufficient detail to be useful to all sectors of large or diverse corporations. It is therefore probable that subscenarios, based on the corporate macroscenarios, will have to be developed to suit the need of particular functions or divisions.

Finally, not all features of scenarios will be acceptable throughout the corporation. As a consequence, the scenario draftsman can anticipate many spirited and fruitful discussions about his product. By using scenarios as a means for exploring both the possibilities of the future and the responses of the organization, the corporate forecasters and planners will be able to examine many risks and options in a manner not possible with conventional forecasts. □

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Technological Forecasting

"But Haven't I Been Doing that All Along?"

by Joseph P. Martino

Businessmen, government officials, and others have long been making technological forecasts without really knowing it, says THE FUTURIST's Technological Forecasting Editor. But if this is so, why has there been so much excitement about T/F in recent years?

Technological forecasting is often presented as though it were brand new. Enthusiastic newcomers to the field are particularly prone to do this. They not only attempt to present technological forecasting as something new, but claim that it will replace some or all of the "old-fashioned" management techniques currently in use. To what extent are they correct? How much of technological forecasting is really new? To answer these questions, we must put technological forecasting in proper perspective. We can then see what the current high level of interest in the subject is all about.

What is a technological forecast? Here we are concerned not with a precise definition, such as may be found in one of the technical books on the subject, but merely a general definition. In simplest terms, a technological forecast is a statement made in the present, about the technology that will exist, or could exist, or should exist, at some time in the future. The forecast may be an unqualified statement that a certain technological capability will be available at a certain time in the future, or it may be a statement that a certain technological capability could be available by a certain time if the effort is made to achieve it, or it may be a statement that a certain technological capability should be sought in order to make possible the solution of some foreseeable problem. In any event, a technological forecast is a statement about the status of technology at some time in the future.

When is a technological forecast needed? Here we are concerned only with those forecasts prepared as decision information, not those prepared primarily for amusement or similar purposes. A technological forecast is needed whenever a decision to be made in the present is affected by the technological conditions of the future. It must be remembered that although decisions are made *in* the present, they are not made *for* the present. Instead, they are made for the future. When a decision maker is confronted with two or more possible courses of action, he selects the one he believes will be the best when it is

viewed from the perspective of the future. But he can do this only when he takes into account the conditions which will exist in the future. Thus in order to make a good decision in those cases where the decision is affected by technological change, the decision maker needs a technological forecast.

At this point, however, the decision maker may ask the question in the title, "Haven't I been doing that all along?" He will argue that he does in fact take future conditions into account when he makes a decision. That, he will claim, is what decision making is all about. He may then go on to ask why there is now so much excitement about something he has been doing for years.

How does the technological forecaster respond to such a claim? The enthusiastic newcomer to the field may attempt to deny that most decision makers take future conditions into account. This is hardly calculated to gain the confidence of the decision maker, who will resent being told he's not doing his job right. As is often the case, however, the disagreement between the forecaster and the decision maker is more apparent than real. They are in fact talking about two different things, often without realizing it. When these two things are clarified, the disagreement between the forecaster and the decision maker disappears.

All Decisions Contain Implicit Forecasts

There is a saying which has almost become the slogan of the technological forecaster, "There is no such thing as 'not forecasting'." Though the saying has practically become a cliche, it does contain a kernel of truth: Any decision contains an implicit forecast of future conditions. In particular, it contains a forecast that the future will be such that the course of action chosen will prove better than any alternative course of action. In principle, it is possible to take the set of options which were open to the decision maker, observe the course of action he actually selected, and deduce from these the forecast he used. Hence forecasting is inescapable. Even if the decision maker were to try to avoid using a forecast, he would be unable to do so. He could not even escape using a forecast through selecting his course of action by some random means. The odds he would assign to a course of action would imply a probability for the possible futures in which that course of action would be the right decision.

Given that forecasting is inescapable, then clearly the decision maker is right when he claims that he has been using technological forecasts all along. Every decision he has ever made has involved a technological forecast. But, if so, why should there now be so much interest in technological forecasting? What is so exciting about something that decision makers have been doing for years?

"A technological forecast is needed whenever a decision to be made in the present is affected by the technological conditions of the future. It must be remembered that although decisions are made in the present, they are not made for the present. Instead, they are made for the future."

Decision Makers Are Unaware of Forecasts

Before we can answer the question of what's new about technological forecasting, we have to look at the truth in the technological forecaster's claim that decision makers have not been using forecasts. The claim is based on the lack of explicitness in the forecasts used in the past. While it is true that every decision always involves a technological forecast, in the vast majority of cases the decision maker is totally unaware of the fact that he is making or using a forecast. He may, for instance, make the implicit forecast that technology will remain static. He may make the implicit forecast that the technology of the future will use the same principles and techniques as today's technology, and merely be somewhat improved. He may make the implicit forecast that technological change will be so slow that he can wait until it occurs and then adapt to it, rather than planning ahead for it. In some few cases, he may recognize that technological change can impact on his decision, and make use of "expert opinion" about the nature and degree of change to be expected. Thus even though the decision maker has always used technological forecasts, he may not have been aware of what he was doing, or at best he may have used a non-explicit means for obtaining the forecast.

The difference between technological forecasting as it was practiced in the past and as it is currently being practiced is the degree of explicitness and reproducibility of the methods. The object of current research in technological forecasting is to replace the implicit methods of the past with explicit methods based on a combination of theory and empirical data. These methods are explicit in that every step of the process is accessible to an outside observer, who can independently verify that the step was done correctly. This change in methods merely parallels changes being made in other areas of decision making, where implicit methods and "expert judgment" are being replaced by calculations based on scientific knowledge, through such tools as operations research, systems analysis, and market research.

Thus we must distinguish between the forecasting of technology, and specific methods for making forecasts, particularly those new methods now coming into popularity. The tools themselves are new, though the use to which they are put is not. These new tools improve the quality of the result, and offer a competitive advantage to the decision maker who adopts them in place of the implicit methods he used in the past.

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Technological Forecasting for Decisionmaking

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CHAPTER 19

Some Common Forecasting Mistakes

1. Introduction

It has been suggested frequently that the art of forecasting can be improved by the study of past forecasts by determining why they went wrong. As several previous chapters in this book have indicated, whether or not a forecast comes true is hardly the proper criterion by which it should be judged. Nevertheless, there certainly is some appeal inherent in this criterion. First, it appears unambiguous. Second, if the forecast itself is not of a self-defeating nature, then its utility for decisionmaking is probably highly correlated with its eventually coming true. Third, there is, in retrospect, probably no other measure of the utility of a past forecast, since in general we do not have access to the decisions which were based on the forecast. Hence despite the admitted shortcomings of "coming true" as a measure of the utility of past forecasts, until better records of decisionmaking are kept and made available to scholars, this may be the best we can manage.

It is interesting to observe that in some cases it is hardly possible to tell whether a past forecast has come true or not. For instance, the forecasts contained in the original Gordon–Helmer Delphi study were examined six years later, in an attempt to assess their validity. It was found that, despite all the attempts during the original sudy to make the statements of events as unambiguous as possible, in many cases it was impossible to tell whether an event in question had yet occurred or not. From the hindsight vantage point of six years later, it was clear that many of the statements were a great deal more ambiguous than they were originally thought to be. Hence it may not always be possible to tell whether or not a forecast has come true.

Despite this problem, and despite the problem of self-defeating forecasts, however, there is much to be learned by examining past forecasts, particularly those which "went wrong" in some spectacular fashion. To the extent that the sources of error can be identified specifically, the present-day forecaster can learn to improve his forecasts by avoiding them. We will look at some typical examples of forecasts which turned out to be dramatically wrong, and examine some of their identifiable sources of error.

One example of an erroneous forecast is given by Lord Bowden (*1*) in a description of some of his early experiences with Ferranti, the British computer firm. "I went to see Professor Douglas Hartree, who had built the first differential analyzers in England and had more experience in using these very specialized computers than anyone else. He told me that, in his opinion, all the calculations that would ever be needed in this country (i.e.,

Great Britain) could be done on the three digital computers which were then being built—one in Cambridge, one in Teddington, and one in Manchester. No one else, he said, would ever need machines of their own, or would be able to afford to buy them. He added that the machines were exceedingly difficult to use, and could not be trusted to anyone who was not a professional mathematician, and he advised Ferranti to get out of the business and abandon the idea of selling any more of them."

George Chatham (*5*) quotes a forecast regarding the future of the turbine engine for aircraft: "In its present state, and even considering the improvements possible when adopting the higher temperatures proposed for the immediate future, the gas turbine could hardly be considered a feasible application to airplanes mainly because of the difficulty in complying with the stringent weight requirements imposed by aeronautics. The present internal-combustion-engine equipment used in airplanes weighs about 1.1 pounds per horsepower, and to approach such a figure with a gas turbine seems *beyond the realm of possibility with existing materials.* The minimum weight for gas turbines even when taking advantage of higher temperatures appears to be approximately 13 to 15 pounds per horsepower," (italics in original). (Note: This forecast was prepared by The Committee on Gas Turbines, of the National Academy of Sciences, and published on June 10, 1940.)

Several examples of erroneous forecasts are given in Jantsch (*10*). He quotes an IBM estimate made in 1955 that by 1965 there would be 4,000 computers in use in the U.S., whereas the actual figure was 20,000. He also quotes the Chairman of the Board of United Airlines as stating that he had "never visualized the speed and comfort of today's jet travel, the volume of air traffic, or the role of air transportation in American national life."

In 1935, C. C. Furnas wrote a book entitled *The Next Hundred Years,* in which he made a sizable number of forecasts of the technological advances to be expected by the year 2035. In the mid-1960s, he reviewed some of his own forecasts as being spectacularly off the mark (*6*). Some of the forecasts he selected as being in serious error were the following:

"It seems obvious that one task confronting aviation is to improve design of planes so that they can improve performance at the higher altitudes. It certainly can be done. . . Three hundred fifty miles per hour for transport planes at the higher altitudes is not an unreasonable figure to expect. That brings San Francisco within 8 hours of New York and London within 10 hours."

"If man could only induce matter, any kind of matter, to explode into energy then he would have a power house that really is something. Half a pound of matter, says Professor Aston, would contain enough energy to drive a 30,000 ton vessel from New York to Southampton and back at 25 knots. Can the atomic physicists show us how to tap that reservoir profitably? The last word has not been said yet but do not buy any stock in an Atomic Energy Development Company. You will certainly lose."

"It is about time that some of the glory of taking lunar trips be robbed from the pages of Jules Verne. Silly chatter? Perhaps. Perhaps not. There is nothing fundamentally erroneous in the idea. I do not doubt that some day a great crowd will gather at some aviation field to watch a man be

locked into a peculiar bullet-like machine on the first bonafide trip to the moon. I hardly expect it to be in my day. . ."

Some of the most extensive studies of past forecasts have been carried out by James R. Bright. One forecast which he has reported (*3*) on is a study sponsored by the U.S. Government, Department of the Interior, in 1937. According to Bright, about 60% of the individual forecasts in this study have actually come to pass. Nevertheless, the authors of the study missed radar, the jet engine, nuclear power, antibiotics, nylon, and a number of other economically significant technological advances of the decade or two following their study.

These examples of the errors of past forecasts have all been instances of the underestimation of possible progress. It should not be thought, however, that underestimation is the only possible direction to err. Errors of overestimation are made too. For instance, the authors of the 1937 forecast mentioned above anticipated a rapid growth in private flying, in the 1940's and 1950's, which simply did not take place. They also forecast, for the immediate future, facsimile printing of newspapers in the home.

Thomas J. O'Conor (*8*) made a study of the so-called Von Karman Report, a report prepared in 1945 by a team of some of the most outstanding scientists in the U.S., under the leadership of Dr. Theodore von Karman. This report was prepared at the request of General H. H. Arnold, Commander of the U.S. Army Air Forces, and was intended as a guide for Air Force research and development in the post-World War II era. The authors of this report forecast the use of Flying Wing aircraft, which in fact turned out to be inferior to other types; the use of nuclear power for propulsion of aircraft, which is still a long way from technical feasibility; the supersonic propellor, which was bypassed by the jet engine; and the widespread use of "supersonic pilotless aircraft" (later to be known as "cruise missiles"), which were bypassed by the ballistic missile. In all of these cases, the authors of the report overestimated the technical capabilities of the devices they forecast.

These instances of the errors contained in forecasts of the past are not intended in any way to denigrate the competence of the forecasters who made them. In general, the forecasts quoted above were made by men of outstanding stature. Especially in the cases of the reports requested or commissioned by government organizations, the forecasters were among the most competent scientists in the country. Just as with the erroneous negative forecasts which we will examine in the next chapter, our objective in studying them is to recognize that even competent people can make errors. Our main concern is to identify the causes of these errors and attempt to avoid repeating them.

In the remainder of this chapter, some of the causes of error will be identified specifically, and procedures given which can help reduce the likelihood of their repetition. Even if these errors are avoided, however, this will not guarantee perfect forecasts. As Winston Churchill is reputed to have once remarked, "These mistakes will not be repeated. We will make enough of our own." Nevertheless, eliminating known causes of error to the maximum extent possible cannot but help improve the utility of forecasts to decisionmakers.

2. Environmental Factors Which Affect Forecasts

Many of the studies of past forecasts have concluded that a significant cause of error is the underestimation or complete omission of certain factors in the environment which could have impact on the technology being forecast. That is, the forecaster takes a narrow look at only the technology he is trying to forecast. As a result, his forecast may be rendered invalid by some factor which he either ignored completely or whose impact he grossly underestimated. The possibility of this type of mistake can be reduced by systematically examining environmental factors which can have an impact on the technology being forecast. We will look at some of these factors, utilizing as a framework the dimensions of the environment first introduced in Chapter 3. Each dimension will be examined separately, and some factors whose impact had led to the failure of past forecasts will be identified.

Technological. A common mistake of forecasters is to fail to look at all of the stages of innovation, particularly the early ones. Most of the items missed in the 1937 forecast discussed in the previous section, such as penicillin, were actually in existence at one or the other of the early stages of innovation. Had the forecasters looked closely at items which were then perhaps at the stage of scientific findings or laboratory feasibility, they might not have missed taking them into account. Hence the forecaster should make a deliberate search for such items in the early stages of innovation as might impact on his forecast.

Another common failing of forecasters is to ignore developments in other fields, or other countries, which may supersede the technology they are trying to forecast. For instance, someone trying to forecast the future of vacuum tubes in 1945 would have missed the work on semiconductors which led to the transistor had he concentrated solely on the field of vacuum tubes. In an actual case, a forecast of materials for the U.S., made in 1950, failed to identify the impact which the basic oxygen process would have on steel-making within the subsequent decade, even though this process was already being adopted on a large scale in Austria. Thus the forecaster should look at other technologies, other industries, and other countries, for developments which might supplant or supersede the technology he is trying to forecast. He should look not only at the later stages of innovation, but also the earlier ones.

Another common failing of forecasters is to ignore the impingement of one technology on another. The widespread growth of the computer, for instance, might not have been possible without the transistor, or something which shared its properties of low cost, high reliability, and low power consumption. Vannevar Bush's forecast, which will be mentioned in Chapter 20, about the impossibility of an ICBM quite possibly arose from a failure to take into account simultaneous improvements in propulsion, guidance, and warheads. Hence the forecaster should examine not only the technology he is concerned with but also its supporting and complementary technologies. The interactions between them may be such that a predictable improvement in a supporting or complementary technology may greatly alter the growth rate of the technology being forecast.

Finally, a common failing of forecasters can be classified as "scientific error" or "incorrect calculation." This may take the form of an assumption that the present state of scientific knowledge represents some final or ultimate level of knowledge. It may also take the form of a calculation which is formally correct but which uses unduly pessimistic or optimistic values for certain factors which have not yet been evaluated. Or it may take the form of an assumption that something will be done "the hard way," or "by brute force." This type of assumption led to the error in Campbell's calculations of the performance of a moon rocket, to be mentioned in Chapter 20. Such an error may be particularly significant when it occurs in the calculation of an upper limit to a growth curve. The forecaster must then make sure that his assumptions and calculations do not treat the present level of scientific knowledge as the last word, that the values assumed for some as-yet-unknown factors are not all biased one way (a good practice is to carry out the calculations with both an optimistic and a pessimistic bias, and see what difference it makes), and that he takes into account the cleverness people have shown in the past in overcoming supposedly "ultimate" barriers.

Economic. Typical failures here arise from an overoptimistic estimate of the acceptance of some innovation, or an overpessimistic estimate of the problems of introducing it. For instance, the forecast of facsimile newspapers in the home, cited earlier, failed to take into account the costs to the consumer. This failure often amounts to mistaking the "operational prototype" stage of innovation with the "commercial introduction" stage. Technical feasibility does not necessarily imply commercial success. On the other hand, innovations in financing a new device may overcome the cost barrier. For instance, had IBM insisted on selling its computers, or Xerox on selling its copying machines, probably neither would have been a commercial success. By leasing them to the user, they overcame the barrier presented by the high cost of manufacturing the devices. Hence, if the forecaster is required to predict the "commercial introduction" stage of innovation, or some later stage, he should attempt to avoid either overoptimism or overpessimism in his evaluation of the economic factors.

Managerial. The primary problem here seems to have been the inability to see the impact of advances in managerial technology. New management techniques may make a much more rapid advancement of technology possible. For instance, the managerial technique known as PERT, which was devised for the Polaris program, had a major impact on making that program manageable. Managerial technology has not reached its limit, any more than have many other technologies. Hence the forecaster should be alert to the possibility that the advancement of a technology may be speeded up significantly as a result of better management techniques.

Political. Changes in the political environment can have a significant impact on technological progress. This may arise from the creation of new agencies charged with achieving specific goals (e.g., National Aeronautics and Space Administration, Atomic Energy Commission, Federal Water Pollution Control Agency). It may arise from the replacement of one

official having one set of views by another having different views. This replacement may take place through death, retirement, transfer, or the loss of an election. Changes may also arise from the efforts to foster a specific technology such as agriculture, to control the detrimental effects of another such as pollution from automobiles, or to restrict the growth or spread of yet another, as the U.S. Atomic Energy Commission has attempted to restrict the development of centrifuge technology for separating uranium isotopes, on the grounds that development of this technology would foster proliferation of nuclear weapons. If some event of this nature has already taken place (i.e., the death of an individual, the creation of a new agency), the forecaster should take into account its impact on the technology he is forecasting. If some change is possible (e.g., an officeholder is reaching retirement age, or creation of a new agency has been proposed), he should look at its possible impact. If necessary, he may attempt to obtain a political forecast from an appropriate source. In any case, the forecaster must take into account the impact of possible political changes on the technology he is forecasting.

Social. A major source of error in past forecasts has arisen from failure to take into account changes within society, particularly population growth, changes in the age distribution, and the growth of affluence. In addition, the impact of special interest groups within society, such as labor unions, conservation groups, consumer organizations, etc., must be taken into account. Many forecasts made during the 1930s were seriously in error because they grossly underestimated the growth of population in the U.S. and thereby underestimated the demand for certain technologies and devices such as the automobile. Present population forecasts, calling for significant growth in the U.S. population by the year 2000, may turn out to be equally wide of the mark. Current-day forecasts based on the assumption of continued population growth at the rate of the last decade or so may be as overoptimistic as those of the 1930s were overpessimistic. Thus the forecaster must be aware that population can have an impact on his forecast, and should be consciously aware of the population growth assumptions (or forecasts) he is building into his technological forecast. The same holds true with assumptions about per capita income. And likewise he must examine the possible impact of actions by various groups within society. Even similar kinds of groups may have different attitudes. The United Mine Workers Union, for instance, has encouraged the use of new technology in coal mines. The International Typographers Union, however, has been very slow to permit the utilization of new technology in the printing industry. Thus the forecaster must identify the groups which may have an impact on the technology he is trying to forecast, determine what their attitudes are, and take these into account. Resistance from some group may succeed in slowing the rate of progress well below that which would be feasible from the technical standpoint.

Cultural. Changes in the values subscribed to by society can have an impact on a forecast. One example of a radical shift in the values of American society is the change in attitudes toward education in science and mathematics that resulted from the launch of the first successful arti-

ficial satellite, i.e., the sputnik, by the Soviet Union. Some commentators on the American scene have claimed to see a shift towards a "post-industrial society," which will downgrade the values of the preceding industrial society, values which were responsible for the rapid economic and technological growth of the past generation. Such a possibility would certainly have an impact on any technological forecasts intended to cover the next two or three decades. These shifts in values may be triggered by some external event such as the sputnik. They may also be triggered by the actions of some individual, or by some book, article, or play which brings some problem to sudden public attention. Ralph Nader's book *Unsafe at any Speed* brought the problem of automobile safety to public attention, and triggered a shift in values toward this subject. On the other hand, values may shift slowly and cumulatively, as a result of factors either internal or external to the society, with little notice being taken of the shift until it has reached significant proportions. For instance, the decade 1960–1970 saw a slow but steady shift in the values of youth in the U.S., until a significant proportion of the young people no longer subscribed to the value systems of their parents. In retrospect, this shift seems obvious, but the rate at which it crept up on society was so slow that it was hardly noticed until it had become quite large. The technological forecaster must take into account any recent shifts or current trends in the cultural values subscribed to by society, and should also be aware that his forecast may be invalidated by a subsequent shift in such values. A technology may have its rate of growth slowed down, simply because people no longer care.

Intellectual. Here again we are concerned with values, the values of the intellectual leadership of society. These values are of concern to the technological forecaster from two standpoints. First, the values of the leadership may differ from those of society. In the short term, the values of the intellectual leadership may be more important than the values of society at large, since in the short term, the intellectual leadership is likely to have more influence on the course of development of technology than will the great bulk of society. Conversely, over the long term, the attitudes of society at large may have more influence than those of the intellectual leaders, since they cannot remain leaders indefinitely if they have no followers. If the values of society at large remain unchanged, new intellectual leaders will arise who reflect those values. Second, the values of the intellectual leaders may be precursors of the values of society at large. The technological forecaster may be able to identify forthcoming shifts in the values of society at large by determining what values are currently subscribed to by the intellectual leaders. In either case, whether the values of the intellectual leadership shift to match those of society, or vice versa, the forecaster should not ignore the impact of this dimension on technology. Instead he must attempt to determine what the impact will be, and include it in his forecast.

Religious/Ethical. At the present time, it seems unlikely that any religious group could have a large-scale impact on technological advance, at least on doctrinal grounds. However, it is quite possible that, at some time in

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the future, religious, ethical and professional groups, together or separately, may come to have an impact on technological advance by raising questions about proper goals and objectives for Man. The attitude regarding technology that "we can, therefore we should" is already under attack, and the strength of this attack may increase. In addition, these groups may take stands regarding the personal responsibility of the technologist for any dangers or unwanted side-effects arising from a new design he is responsible for. There have already been suggestions to the effect that a proper code of ethics for engineers would include such personal responsibility. The first of these attitudes may slow the rate of growth of technology generally; the second may give rise to increased empiricism and incrementalism in design, making engineers hesitant to depart too far from something which is known to work safely and reliably, although at a comparatively low level of performance. If either of these changes took place, they would have a significant impact on technology; therefore they are important to the forecaster. In addition, it is possible that other similar changes may have an impact on technology, and therefore be of concern to the forecaster. Hence he must consider the religious–ethical dimension in preparing his forecasts.

Ecological. This dimension is likely to have a growing impact on the course of development of technology. It is therefore of considerable importance to the technological forecaster. For instance, the 1937 forecast mentioned above presented the following forecast regarding waste disposal. "There is no cheaper or better way of disposing of sewage than by dilution with water. . . . Rivers . . . must carry at least all of the soluble wastes of life and industry" (quoted by Bright). The authors of this forecast clearly did not anticipate the impact of this attitude on the environment, when practiced by a much larger and much more affluent population. Since society is becoming more conscious of the necessity to maintain a satisfactory environment, and may well be less likely to tolerate technology which damages the environment, the forecaster must take this dimension into account. In particular, he must recognize that if a certain scale of use of a particular technology produces an intolerable level of damage to the environment, that technology may not be allowed to reach that large a scale, or it may be supplanted by a less damaging technology.

Each of these dimensions of the environment represents a possible source of impact on technology. Therefore, in order to prepare a useful forecast of a technology, it is essential to look at each dimension to attempt to identify the impact. The impact may be an alternative technology to the one being forecast; it may be an acceleration or deceleration of its rate of progress because of a change in the level of interest, demand, or support; it may be a consequence arising from an interaction of several technologies. Whatever the impact, it must be identified and incorporated in the forecast. Otherwise the forecast is unlikely to be of any great utility for decisionmaking purposes. It may even mislead the decisionmaker by causing him to neglect the impact of some important developments.

3. Personal Factors Which Affect Forecasts

In the previous section we have examined some environmental factors which could have an impact on technology, and which if ignored could render a forecast worthless. These were derived from studies of the failures and errors of past forecasters. In this section we will examine some factors internal to the forecaster which have likewise been found to invalidate forecasts. These may be harder to identify in specific cases, because the forecaster may not want to admit that he suffers from deficiencies. However, if he is aware of the possibility of their existence, he has a better opportunity to search for them within himself. To the extent that he can identify them and make allowances for them, he will produce a better forecast. It will certainly be more useful and if it is not self-defeating, it is more likely to come true.

Vested Interest. This problem arises when the forecaster has a personal interest in an organization or a particular way of doing things, which might be threatened by a change in technology. The forecaster may have spent his professional lifetime with a particular organization or industry; he may have many favorable or pleasant personal associations or experiences with an organization or a group of people; he may have a feeling of personal commitment to an organization or to a way of life. In any of these cases, he may tend to suppress a forecast which appears to threaten any of these interests. Bright (2) cites two statements made by executives of locomotive manufacturing companies, which illustrate this point. Mr. Robert S. Binkerd, Vice President of the Baldwin Locomotive Works, said in a 1935 speech to the New York Railroad Club, "Today, we are having quite a ballyhoo about stream-lined, light-weight trains and Diesel locomotives, and it is no wonder if the public feels that the steam locomotive is about to lay down and play dead. Yet over the years certain simple fundamental principles continue to operate. Sometime in the future, when all this is reviewed, we will not find our railroads any more dieselized than they are electrified." Mr. W. C. Dickerman, President of the American Locomotive Company, said in a 1938 speech to the Western Railway Club in Chicago, "For a century, as you know, steam has been the principal railroad motive power. It still is and, in my view, will continue to be." However, as we saw in Chapter 6, from Mansfield's work on the rate of diffusion of innovations in various industries, the diesel locomotive followed the typical growth curve quite closely. In fact, Mansfield's data showed that by 1935, 50% of the railroads in the U.S. had already bought at least one diesel locomotive. Diesels, no doubt, accounted for far less than 50% of all locomotives at that time, but the trend was clearly there (or at least it is clear now in hindsight; it obviously was not clear to everyone in 1935). At any rate, here we have a clearcut example of two forecasters who had a commitment to a particular technical approach; so much so that their companies failed to anticipate the transition to a new technical approach despite the evidence available to them. Thus the forecaster must be wary that a vested interest in some organization or some way of doing things may blind him to the true implications of the evidence he is examining. He may, consciously or unconsciously, refuse to forecast

a technological development which would threaten his vested interest. Note, however, that he is doing no favor to himself or to the decisionmaker who utilizes his forecast by this blindness to truth. The impact, when it comes, will be all the more severe for being unexpected. Thus the forecaster must do everything he can to assure that he does not suffer from being swayed by his vested interests.

Narrow focus on a single technology or technical approach. In this situation the forecaster looks only at one specific technology or technical approach. This situation differs from the previous one in that the narrow focus arises from the forecaster's experience or training, rather than from a vested interest. Because of this experience or training, the forecaster is conditioned to think only in terms of one type of solution. This may lead him into making a "window blind forecast" of the type described in the first chapter, and he may fail to identify a technical approach which could replace or supplant the one he is forecasting. Typical examples of this problem may be found in such compilations as *The World in 1984* (*4*). As one instance, we find in this book a chapter written by a railroad engineer which describes the railroads of 1984, looking much like an updated version of the railroads of today. Yet in the immediately preceding chapter, we find a description of a tracked hovercraft which, if it becomes feasible by 1984 as expected by the author, will completely obsolete the conventional train as it has been known since the time of Stephenson and Tredgold. This is not to assert that the author of the article on railroads is wrong. It is to say, however, that in his forecast of land transportation, he looked at only one technology, apparently as a result of his background and experience, and closed his eyes to another which might supplant the one he was forecasting. There is real danger, therefore, in the forecaster missing some important development as a result of the narrow focus of his attention.

Commitment to a previous position. This situation arises when the forecaster has prepared a forecast on a particular topic at some previous time, and is asked to take another look at the same or a related topic. As a result of the earlier forecast, he may be unwilling to make any alterations, even in the face of new information. This may result from a false personal commitment to his previous work, leading to an unwillingness to recognize that recent information may require his inferences to be changed. Or it may result from a feeling that if he changes his previous position, he will lose credibility or stature in the eyes of his clients or of the public. Thus even if he recognizes that more recent information has significant implications for the field he is concerned with, he may be unwilling to make changes in his previous forecast. It should be apparent that no matter what the reason for reluctance to change a previous stand, the situation can be dangerous. The forecaster's reputation is likely to suffer much more when his clients recognize he is unwilling to take new information into account, than it is if he admits that an earlier position was based on incomplete information and no longer appears as soundly based as it did at the time he took it. The forecaster must examine his own attitudes carefully to be sure he is not inadvertently committing this mistake.

Overcompensation. This situation arises when the forecaster realizes he has a personal commitment to a particular view, a vested interest in some technology, or a strong desire to see a particular result, and bends over backwards to prevent this commitment or desire from distorting his forecast. As a result, he distorts it in the opposite direction. This distortion is just as bad as the distortion arising from a commitment to a particular technology, organization, or viewpoint. It is harder to detect, however, both by the forecaster himself and by his clients. Hence the forecaster must be just as aware of this possibility as he is of the more obvious forms of bias.

Giving excessive weight to recent evidence. It is only natural that recent events will loom large in the mind of the forecaster; larger than events of the more distant past, even when the latter may contradict the recent events. If some activity has been following a long-term rising trend, for instance, but has recently had a downward fluctuation, similar to many minor downward fluctuations in the past, the forecaster may give more weight to the recent downward fluctuation than he does to the long-term trend. While this may be natural, it is certainly not conducive to effective and useful forecasting. The forecaster must look for long-term trends, and make a forecast which is contrary to these trends only when he has good reason to believe that the phenomenon is in fact departing from the trend. To ignore the trend and base a forecast solely on the latest fluctuation, either up or down, is asking for trouble. If the long-term trend is still continuing, there will inevitably be a counterbalancing fluctuation to offset the one on which the forecast is based. It is essential, then, that the forecaster give proper weight to all relevant evidence, including that from the bulk of the past. If one of the rational and explicit means of forecasting, described earlier in this book, is used to prepare the forecast, the danger from this problem is somewhat reduced. In such a case, it is obvious to both the forecaster and the forecast user which data have been used and which omitted. The reasons given by the forecaster for omitting specific items of data are more readily analyzed. However, even in this case, there is still the possibility that the forecaster will fail to use earlier data, not because of any rational conviction that it is no longer relevant, but simply because of a subjective feeling that "it doesn't fit with more recent events." Hence there is no sure cure for this problem, and the forecaster must take pains to avoid making such a mistake.

Excessive emphasis on the troubles of the recent past. This is a more vicious form of the preceding deficiency. Serious troubles are likely to make a deep impression on the forecaster, giving him a predisposition toward a particular outlook. He may come to accept the troubles as permanent, instead of recognizing them as a temporary phase which may recur, but need not. Schoeffler (9) gives an extensive description of this problem, in terms of economic forecasts prepared in the early 1940s, with regard to reconversion of the U.S. economy from wartime to peacetime production. Virtually all the forecasts made at that time foresaw extensive unemployment, slow growth in the level of production, and general economic stagnation. Schoeffler has identified some specific errors made in these forecasts, a few of which are itemized below:

(1) Industrial reconversion tempo underestimated.
(2) Construction revival misjudged.
(3) Quick retirement of emergency workers after V-J day.
(4) Underestimate of effective foreign demand.
(5) Rush to build up inventories underestimated.

There were a considerable number of these specific errors, which Schoeffler has summarized thus: "Continued reflection upon the etiology of the forecasting errors leads the writer to the conclusion that the underlying cause of the errors was *psychological*—not theoretical, statistical or methodological.

"The originating cause of most of the reconversion forecasting errors was the prevailing psychological 'mind-set toward depression' among the forecasters. Most of the forecasters had an unmistakable predilection to look at the economy through the dark glasses of the 1930s. This predilection had profound consequences for economic forecasting of postwar conditions. Almost inevitably, it led to an acceptance of the stagnation of the 1930s as the economic norm for the American economy of the twentieth century. Given this bias, it was natural to regard *re*-conversion as a return to basic prewar conditions and to minimize the continuing economic consequences of the war" (italics in original).

Nor were the effects of the depression limited to the years immediately following it. Ikle (7), writing in 1966, stated: "We make the mistake of focussing our predictions where our shoe hurts. If we have been hurt particularly badly, our predictions will look backwards to our old pain for a long time. The Great Depression of the 1930s had a depressing effect on all social predictions; this cast a longer shadow into the future than the real dislocations of the Depression itself. On a number of issues, our predictions are *only now* recovering from the Great Depression. Thus the volume *Recent Social Trends,* written just before the worst years of the Depression, takes a view of the future in many ways closer to our current agenda for predictions than the planning and forecasting done for some twenty years following the Depression" (italics added).

Since this problem is closely related to the one described in the preceding subsection, the procedure for handling it is much the same. The forecaster must make a deliberate effort to look for long-term trends and behavior, instead of concentrating on recent events. This will be especially difficult, since as both Schoeffler and Ikle indicate, serious troubles may easily be interpreted as representing basic structural changes in the situation which render older data irrelevant. The awareness that this can happen, however, can be helpful in counteracting the tendency to assume a structural change, since rendering this assumption explicit makes it easier to examine and either verify or invalidate.

Unpleasant Course of Action. Sometimes the course of action which seems to be made necessary by a forecast will appear so unpleasant that the forecaster shrinks from making the forecast itself in the hope of thereby avoiding the necessity for the action. Ikle (7) makes the following comments on this problem: "Some predictions imply such a horrible course of action that we experience a failure of nerve and find ourselves unable to go through with the indicated choice. This might be called the 'non-

Freudian Oedipus effect.' " The reference here is to the parents of Oedipus, who lacked the courage to make sure their son was killed. Our concern here is with the forecaster who lacks the courage to take the necessary action, and therefore refuses to make the forecast which would require the action. This attitude can only be described as head-in-the-sand. The forecaster whose nerve fails him in an adverse situation is helping neither himself nor the client for whom he is preparing the forecast. It is admittedly not very helpful to give advice in terms of "you must have the courage to face the consequences of your own forecasts, or else stay out of the forecasting business." While the advice is sound, the forecaster who needs it is probably least likely to heed it. However, if the forecaster is aware of the possibility of stumbling into this pitfall, he has a better chance of avoiding it.

Dislike of the source of an innovation. There are cases where an innovation which already exists should be taken into account, as having an impact on the technology to be forecast. However, the forecaster may for some reason have acquired a dislike for the source of the innovation. This source may be an organization, or it may be an individual. In either case, the forecaster's dislike of the source may cause him to ignore the innovation and its potential consequences. This attitude is not rational, nor is it conducive to making an effective and useful forecast. It is, however, human. If the forecaster is aware that the possibility of this attitude exists, and is honest with himself about whether he suffers from it, he has a much better chance of avoiding this mistake.

Systematic optimism–pessimism. It has been observed, through studies of many forecasts, that there is a systematic shift from optimism to pessimism as the time length of a forecast increases. In the short run, many forecasters tend to be optimistic, especially about work they are responsible for. They feel confident that the immediate obstacles can be overcome, and usually underestimate the effort required to overcome them. In the long run, however, they tend to be pessimistic. They see many difficulties and barriers which they do not at the moment see how to overcome. Thus these difficulties loom large and make the forecaster forget that difficulties of similar magnitude have been overcome in the past. In effect, they make an implicit forecast that the historical rate of innovation will slow down or come to a complete halt. A useful rule of thumb is that the shift from optimism to pessimism comes at a point about five years in the future. While this may not be absolutely accurate, it can be helpful in warning the forecaster of where to expect one psychological attitude to be replaced by another. In any case, the forecaster should be aware that this tendency to shift from short-term optimism to long-term pessimism is a natural one, and that by being aware of it he can minimize its effect on his forecasts.

It should not be thought that every forecaster is inevitably afflicted with each one of these deficiencies. Many will be afflicted with at most one or two, and some fortunate souls will escape them entirely. However, the forecaster should take into account that he is a human being, and is therefore afflicted with human frailties. Some of the frailties which in the past have contributed to reducing the usefulness of a forecast have been mentioned above. If the forecaster takes into account the possibility that they

might afflict him, he has a much better chance of avoiding them, and thereby increasing the usefulness of his forecasts, than if he simply assumes that he is immune to the failings of ordinary mortals.

4. Summary

This chapter has covered some of the common mistakes made by forecasters. These mistakes have been identified by studies and reviews of past forecasts, and can be grouped into two categories: environmental factors and personal factors.

The environmental factors represent influences originating in the environment in which the technology being forecast exists. If the forecaster concentrates solely on the technology he is concerned with, he is likely to miss these factors and thereby produce a forecast which is less useful than it might have been. By systematically examining the environment, using the dimensions introduced earlier, it is possible for the forecaster to reduce the likelihood that he will omit or overlook some significant factor and thus invalidate his forecast.

Personal factors represent psychological and other factors internal to the forecaster which may cause him to inadvertently or unconsciously distort his forecast. A checklist of common mistakes of this type is given in the chapter. The forecaster can use this list to help assure himself that he is avoiding the mistakes which arise from these factors.

There can be no absolute assurance that the forecaster is avoiding the mistakes described in this chapter. However, by being aware of the possibility of making these mistakes, and making a conscious effort to avoid them, he has a much better chance of preparing an error-free forecast. He should always keep in mind that mistakes have been committed by some of the most eminent scientists and engineers of the past, that he is not automatically immune to them, but that by conscious and systematic effort, he can certainly minimize, if not eliminate, them.

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Problems

1. What benefits can the forecaster derive from studying past forecasts produced by others in his company, industry, government agency, etc.?
2. What benefits can the forecaster derive from studying his own past forecasts?
3. In which dimensions is the expert opinion of a specialist likely to be of help identifying factors which might affect a forecast? In which of these dimensions is it likely to be essential?
4. Many professional forecasters are employed by large organizations, to make forecasts for use in the planning process of their organization. Much of their work involves forecasting those technologies with which their organization is involved. What can they do to help overcome the problem of vested interest?
5. What were the errors made by the authors of the following forecasts?
   a. Roger Revelle, in *The World in 1984,* written in 1964, forecast that a worldwide network of meteorological satellites, coordinated with a worldwide network of buoys in the open ocean, carrying meteorological instruments and reporting surface conditions by radio, would be established by 1970.
   b. In 1936 P. K. Whelpton prepared a forecast of U.S. population through 1980. Most of his work involved some very elaborate statistical methods for estimating unregistered births, to get an accurate estimate of the population in each age bracket in 1936. He then assumed three different fertility rates and three different mortality rates. These were as follows:

      High fertility—the historic decline in fertility would halt and fertility would continue at the 1930–1934 rate, 2177 births per 1000 women.

      Medium fertility—the historic decline in fertility would slow down, reaching a level of 1900 births for 1000 women living through the childbearing period in 1980.

      Low fertility—the historic decline in fertility would slow only slightly, dropping to 1500 births per 1000 women.

      Low death rate—the life expectancy at birth would rise from 62.4 years in 1934 to 73 in 1980.

      Medium death rate—life expectancy at birth would rise to 70 in 1980.

      High death rate—life expectancy at birth would rise to 67 in 1980.

He combined these possible birth and death rates into six different series. The highest and lowest series, as a percentage of the actual population in various years, are shown in the following table.

Year	Low series	High series
1940	99.2%	100.3%
1945	95.8	99.4
1950	89.7	96.3
1955	82.9	92.4
1960	76.3	88.7
1965	70.1	85.6

Note: Whelpton's forecast can be found in Whelpton, P.K., An Empirical method of calculating future population, *Journal of the American Statistical Association* **31,** 195, (1936). The material given here is taken from the discussion in Paterson, Robert W., *Forecasting Techniques for Determining the Potential Demand for Highways* (Columbia: University of Missouri), 1966.

c. After the Wright Brothers' successful flights in December, 1903, there was considerable popular interest in the subject of aviation. Octave Chanute, the aviation pioneer, whose work with gliders antedated the Wrights' experiments, made this forecast of the future utility of aircraft in March of 1904: ". . . The machines will eventually be fast, they will be used in sport, but they are not to be thought of as commercial carriers. To say nothing of the danger, the sizes must remain small and the passengers few, because the weight will, for the same design, increase as the cube of the dimensions, while the supporting surfaces will only increase as the square. It is true that when higher speeds become safe it will require fewer square feet of surface to carry a man, and that dimensions will actually decrease, but this will not be enough to carry much greater extraneous loads, such as a store of explosives or big guns to shoot them. The power required will always be great, say, something like one horse power to every hundred pounds of weight, and hence fuel can not be carried for long single journeys."

6. Take some current forecast and determine whether the forecaster overlooked potential impacts from developments in any of the dimensions of the environment.

THE ROLE OF FUTURES RESEARCH IN CORPORATE PLANNING

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The Role of Futures Research in Corporate Planning*

Selwyn Enzer**

Forecasting is not new to corporate planning, but futures research--an evolving discipline which attempts to formalize the art and science of forecasting--is just beginning to impact the corporate scene. Futures research expands the concept and role of forecasting to make it more relevant and crucial to business planning and decision making. The central theme of futures research is to expand futures thinking from passively forecasting evolving conditions to developing an improved understanding of options so that decision makers can take active roles in creating future conditions. To do this we must stop thinking about the future as though it were preordained and simply unknown or unknowable to us. We must dispel the images created by our exposure to fictional fortune tellers who describe it as an immobile singular outcome. These images have left scars on our views of the future which tend to prevent us from seeing how our actions can affect the outcome. These blind spots leave us with only the ability to see defensive measures.

Futures research attempts to change this mindset by introducing the concept of alternative futures. The future is not singular. We can affect outcomes, occasionally we can even change the seemingly inevitable.

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have a defined sample space to work with. Hence, futures research is not a scientific discipline and cannot be expected to develop closed-form models which can be used to describe future possibilities with the rigorous precision of the probability mathematics it clumsily attempts to use. Instead it concentrates on the development and application of systematic processes and procedures which are intended merely to assist in appreciating alternatives more completely than might otherwise be possible. In the course of applying such procedures the identification of new alternatives is a frequent occurrence. Such instances of inventing the future are important, but are by no means a certain product of futures research.

Different Forecasts for Different Purposes

Futures research analyses can be arranged in three categories: exploratory forecasting, normative forecasting, and technology assessments.

Exploratory forecasting activities attempt to understand what alternative futures are possible and to define future scenarios assuming that the forces at work in our society are held constant. Constancy, in the sense referred to here, does not mean a static society, merely one in which present values, goals and objectives continue to exhibit an evolutionary development; and that abrupt changes do not occur. If our society were likened to a ship, the exploratory function would be similar to that performed by the look-out or the man in the crow's nest.

Exploratory forecasts are not open-ended, but center on some subject or issue of interest. These may be broad subjects such as the energy situation in the next thirty years, or narrow topics such as technological

developments in the steel-making industry in the next ten years or industrial development in Bakersfield, California over the next decade. Clearly, the degree of resolution needed in the forecast is likely to be much greater for the narrower than for the broader topics.

Normative forecasting activities are concerned with the identification of an optimal path for reaching a desired future state. Normative forecasts should follow exploratory forecasts since the latter provide basic inputs for the goal selection process and for understanding the external conditions surrounding the normative forecasts. In other words, because a normative forecast is concerned with establishing a long-term course of action, it needs information concerning changes in the external environment relative to those actions that are likely to occur over the long-term future. This information is part of the exploratory forecast.

While a normative forecast is focused on achieving a specific end state, it is also concerned with the intermediate conditions realized while pursuing an optimal path. For example, an efficient normative course of action that achieved a desired goal of "full" employment would probably be rejected if it increased unemployment significantly over an extended interim period.

Using our shipboard analogy again, the task of normative forecasting is assigned to the navigator. He, too, is concerned, not just with the end state, but also with positions and hazards that may occur at intermediate positions. He is concerned with, for example, what the weather will be like in those places and at those times that correspond to the ship's path in the same way that the normative planner is concerned with external changes in the environment.

Technology assessments are studies directed at exploring the impacts on society of the introduction of a new technology (social or physical), or the expansion or extension of an existing technology in new or different ways or to a new and greater extent than in the past.* In other words, technology assessment is concerned with the impacts that might occur assuming that some change will occur or that a plan laid out by a normative forecast is successfully executed; and it places particular emphasis on the full spectrum of social impacts that may occur as a result of the change. In our shipboard analogy, this is the captain's responsibility and, interestingly, there is no formal assignment of this activity to any supporting personnel. However, in the U.S. Government, an Office of Technology Assessment has existed for about a year. This Office conducts assessments for the legislative branch and reports directly to the Congress.

Different Models for Different Forecasts

At the heart of all of the above activities are individual or specific forecasts about some event or trend and overall environmental descriptions which synthesize many individual forecasts. These forecasts are generally categorized according to the degree of confidence with which they can be made; in other words, according to the degree of understanding the forecaster possesses concerning the behavior of the system. One might regard five categories of individual forecasting models as being sufficiently distinct to be classified separately. These are forecasts based on:

- Scientific Predictions
- Quantitative Models

* Joseph F. Coates, "Technology Assessment: The Benefits...the Costs... the Consequences," The Futurist (December 1971).

- Extrapolative Models
- Reasoned Opinions
- Speculation

Included in the scientific prediction category are all forecasts based on governing laws and theories which have been tested repeatedly. These include, for example, the trajectory of a missile and the probabilistic outcome of a roll of fair dice. All of the possible outcomes are known to the forecaster in advance (hence, there can be no occurrences which are totally new), and his understanding of the process assures absolute accuracy in the prediction. Scientific predictions also have the unique characteristic of being time-independent. That is to say, it does not matter when the event occurs, prediction is always valid. Scientific predictions are relatively unimportant in futures forecasting except as they represent components in external conditions.

Analytic models are used when some insights into the governing laws and theories exist but are not sufficiently understood to permit predictions with scientific accuracy. Econometricians and weather forecasters are typical users of analytic models. These forecasts are greatly affected by time in that longer future time periods lead to less confident forecasts. However, an even more important distinction can be seen in these two uses of analytic models. In one case, the outcome--what the weather will be--is unaffected by the forecast. Econometric forecasts, on the other hand, may well affect the outcome in that many economic conditions are reinforced by behavioral patterns which anticipate such things as inflation, prosperity, shortages, etc. This issue is an important factor in futures research. It results in the forecast impacting the outcome--the self-

fulfilling prophecy, and its counter, the self-negating prophecy. This makes it very important to maintain objectivity in futures analyses and, incidentally, makes it extremely difficult to evaluate the accuracy of a forecast, even after the time period of the forecast has elapsed. This problem is of course common to all forecasts concerning human behavior.

Extrapolative models are generally used where statistical data describing historical trends exist, but where there is little or no understanding of the governing forces. Frequently the forecaster using historical data will attempt to identify causal relations between historical occurrences and their impacts in order to improve his ability to understand future changes. These may be simple extrapolations or attempts to correlate changes in one trend with others. As an illustration of this process, consider a forecaster attempting to project the number of registered automobiles in the United States in the future. He may believe that this number is somehow related to an economic factor such as per capita G.N.P. To test the correlation, he attempts to derive a mathematical relation which uses per capita G.N.P. to compute the number of automobiles. If, in retrospect, this relation computes a number of automobiles which correlates closely with actual statistics, the forecaster may opt to forecast per capita G.N.P. directly and then use his so-called "regression equation" to compute the expected number of automobiles. In this way, the forecaster uses a trend he regards as easy to project (per capita G.N.P.) to forecast a less understood trend (number of automobiles). It should be noted that correlations of this type do not constitute evidence of any causal coupling between the trends, merely that they have exhibited similar behavior patterns in the past.

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In most areas of change, particularly those which are unquantifiable and those which involve social changes, our lack of theoretical understanding frustrates any attempt to construct meaningful analytic models for projecting future trends. Typical examples of such areas are in changes in values, human behavior, new technologies, and many others. These are areas in which there is sufficient qualitative understanding to permit some insightful commentary, but not enough to create an explicit model; hence, we must resort to the use of the integrative models of reasoned opinion and speculation here. The central issue in pursuing reasoned opinion and speculation as to possible future changes is to identify the types of people whose opinion one would regard as more valuable than any random individual in the area to be forecasted. More can be said, for example, about the likelihood of developing controlled thermonuclear energy than can be said about the prospects for contact with extraterrestrial intelligence by the year 2000. Thus if some insights were desired on these two issues, even though neither of these subjects appears amenable to modeling, the reasoned opinion of nuclear experts might be more useful for the former, while on contact with extraterrestrial intelligence the speculation of people noted for their imagination or even mystics might be best.

Actually, most futures research activities involve all of the above techniques from time to time. Although very few elements of change are scientifically predictable, many are readily modeled. However, the bulk of the information about these models and their future comes from our judgment and imagination.

When these categories of forecasts are compared to the three major activities of futures research mentioned earlier, exploratory forecasting

relies heavily on reasoned opinion and speculation; normative forecasting is closely linked to reasoned opinion and analytic modeling; and assessing technology requires a great deal of reasoned opinion, and speculation with extrapolative and analytic modeling in some cases.

Futures forecasting, particularly when judgment is involved, employs the systematic use of multidisciplinary expertise in an attempt to understand and direct possible alternative patterns of change. We recognize, when we speculate about the future, that our mental images are likely to be influenced by our backgrounds. Hence, it can be very important to create composite images which draw upon the foresight of people from a number of relevant disciplines.

In creating these composite images, regardless of whether they are qualitative or quantitative, it is important to be as systematic as possible. Systematism can mean different things at different times, but basically systematic procedures consist of preparing and using checklists to assure that no stone is left unturned, assuring that compelling factors and limitations are adhered to (for example, that input = output, that demographic "certainties" are respected, that secondary effects of causative changes are accounted for, and so on), and using techniques which highlight the existence of interdependencies among a broad range of seemingly unrelated factors. Use of these devices is more likely to flush out obscure consequences that may otherwise be overlooked.

Applying Futures Research to Corporate Planning

In the process of ensuring systematism and facilitating the integration of judgmental multidisciplinary inputs needed for developing comprehensive plans, many detailed methodologies have been devised. These include polls, questionnaires, brainstorming, Delphi interrogations, simulation, gaming, scenario writing, morphological analysis, relevance trees, decision trees, cross-impact analyses, and a host of other devices, many of which have no formal names. These tools have been used by many corporate planners in many ways to develop internally consistent descriptions of changes to create alternative futures and to develop operational plans or strategies. However, the adoption of a strategy is a decision--indeed a major decision. Consequently it must reflect the expectations and convictions of those responsible for its execution. Therefore, involvement of these people in the development of the plan is extremely important. A tool called cross-impact analysis has proven highly valuable for this purpose.

While cross-impact analysis has been steadily evolving and changing its form, it has always concentrated on understanding the coupling among important future developments for the purpose of identifying possible chain reactions that can be triggered by an event, excessive deviation in the level of a trend, a change in the external environment, or by the adoption of a policy or action program. In corporate planning all of these aspects are important.

A cross-impact analysis involves all three categories of forecasting activities, i.e., exploratory forecasting, normative forecasting, and

technology assessment. These analyses have been performed with both quantitative and qualitative terms and generally involve at least the following six steps:

- Definition of the issue being analyzed.
- Identification of major developments relevant to the issue during the time period of interest.
- Estimates of the probability and timing of these developments.
- Assessment of the coupling among the developments; that is, the change in probability of the other developments produced by the occurrence of any one event.
- Analysis of the above to define interrelated sets of developments where the occurrence of one strongly changes the expected outcomes of others.
- Evaluation of alternative policies or actions considering the intrerelations in assessing their effectiveness in promoting a desired outcome.

Some of the features of cross-impact analyses that make them attractive for corporate planning are: 1) they have the ability to accommodate all types of eventualities (social or technological, quantitative or qualitative, and binary events or continuous functions), 2) they rapidly discriminate important from unimportant sequences of developments, and 3) the underlying rationale is fully retraceable from the analysis.

As indicated earlier, in order for a model to be of value to decision makers, the model must reflect their perception of the real world. If it does, they will find the results acceptable and hence will find the clarification of alternatives produced by the model plausible and beneficial.

To assure maintaining this relevance, it was common practice to elicit all of the inputs for the cross-impact model from the decision makers themselves. However, obtaining the input data, particularly regarding the coupling among the developments (step 4 in the list presented earlier) can be a long and tedious task. To reduce the time required for the analysis, it had been common to limit the number of developments included in the analysis. While this was effective in reducing the decision makers' involvement time, it unfortunately removed much of the richness that the analysis was capable of capturing.

Cross-Impact Analysis in Real Corporate Planning Case

To circumvent these problems several novel modifications to the cross-impact analysis were attempted in a pilot planning effort involving managers of a single profit center at Eaton Corporation.* In this effort the planners (Eaton's corporate planning personnel and the author) structured and conducted the analysis to minimize the time demanded from the managers of a profit center confronting a crucial decision, at the expense of markedly increasing the planners' workload.

This reduction in the effort on the part of the managers was accomplished by: 1) partitioning the events to be included in the analysis into time and causal sequences, and 2) eliciting only part of the inputs from the managers necessary to complete the model.

The Eaton planning effort consisted of three phases. In the first phase the managers were asked to prepare a written listing of the future

* Inquiries concerning this effort should be directed to R. L. Martin, Corporate Engineering and Research, Eaton Corporation, Southfield, Michigan.

developments, events and trends, which they suspect will have the greatest relevance to their planning--that is, the possibilities which could materialize to produce the most severe problems or the greatest opportunities.

These written inputs were collated by the planners. This consisted of commonalizing those that referred to similar situations but used different terminology, separating those that contained several different developments in one statement, and general editing. For those trends identified by the managers for which statistics were available e.g., GNP/capita and rate of inflation, the planners compiled the actual data for use in the second phase.

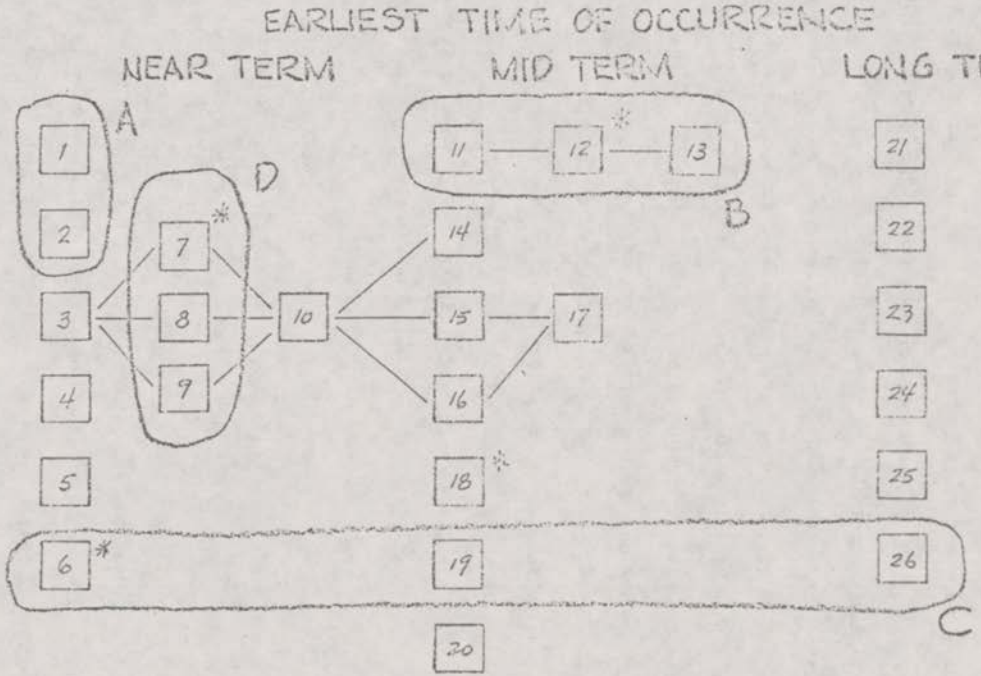
In phase two the profit center managers and the planners spent two days in a remote location to develop the inputs for the cross-impact model. The first part of this phase was concerned with a review of the collated list of developments. This was accomplished in a general discussion which involved the entire group. For the managers, this discussion helped to align their individual viewpoints and promote a better understanding of how their colleagues see the world. The planners benefitted both from the improvement of their understanding of the manager's concerns, and in distilling the set of developments to a practical minimum which were now precisely stated. In this process many of the developments suggested in the written submission were deleted and several new items were added.

Then the outlook of the managers regarding the likelihood and timing of the events, and the upper and lower bounds of the trends was elicited. For this the statistical data compiled by the planners prior to this session proved highly valuable. This step used a mini Delphi procedure. Inputs were elicited anonymously using a voting machine designed and built by

Eaton Corporation. When the group estimates reflected substantial agreement, the median value was accepted and the group proceeded to the next item. When there was disagreement or if one member of the group differed substantially from the rest, discussion was encouraged. Anonymity was protected in these discussions by asking anyone in the group to try to explain what might be the cause of the disagreement rather than asking the dissenters to defend their positions. In the session anonymity frequently proved to be unimportant since the managers were a rather friendly group and took great pleasure in announcing and defending their extreme opinions. These discussions appeared most useful to the managers as evidenced by the large number of occasions when the group opinion shifted markedly.

The next step involved the development of the cross-impact model itself. It is this step that can be most tedious and where the approach was modified considerably over previous applications of this technique. First, the managers never saw a matrix. Instead the planners arranged the events in the manner shown in the attached figure. As seen the events were partitioned into three time periods--the near, intermediate, and long-term. Superimposed on this partitioning are four types of subsets: A) events which may occur in the same time interval, but not in any special sequence--these events may be causally unrelated, B) events which can only occur in a specific sequence (e.g., a situation where 13 cannot occur unless 12 has occurred, and 12 cannot occur until 11 has occurred)--these events may span across more than one interval such as 3 and 15 do, C) events which are likely to occur in a sequence, not because of any absolute dependency but because of their likely time of occurrences, and D) alternative events--similar

PARTITIONING OF FUTURE EVENTS



* AT LEAST PARTIALLY CONTROLLABLE

events where the occurrence of one usually inhibits the others--in a sequence the occurrence of at least one of the alternatives is necessary for a subsequent event to have a chance of occurring. Also identified were those events whose likelihoods of occurrence were believed to be at least partially controllable by the corporation.

Partitioning of the events in this manner not only provides inputs which are essential for the cross-impact matrix, it also reduces the number of needed inputs significantly. One need not inquire as to the impact of subsequent events in a sequence on the prior events or of the long-term events on the near-term events. There may indeed be causal linkages among these events, but if the sequence is believed to be implausible such information is useless and obtaining it is time-consuming. It may even detract from the intellectual attractiveness of the model-building deliberations. Another important advantage to this procedure is that it minimizes the prospects for input errors, particularly double-accounting errors, which are quite common when the contributors are confronted with the matrix arrangement. Incidentally, partitioning does not apply to trends since these are continuous over time. Trends are maintained in a separate subgroup and are evaluated for their cross-impact with all the events and each other.

Notwithstanding the reduction in needed input data permitted by partitioning, the number of development pairs that would have to be evaluated would still have represented an overwhelming task for the managers. Hence, the planners did not elicit all of the inputs from the managers, rather sought only the couplings among <u>key</u> pairs of developments; then

used the understanding of the information provided by the managers on the issue and their insight into the workings of the cross-impact model to identify which pairs of developments were likely to be most important and complex.

This approach proved to be highly effective. The pace and richness of the discussion was maintained at a high level. Both the managers and planners derived considerable insight from these discussions. Toward the end of the second day the planners found it relatively easy to identify several possible alternative actions which the managers might wish to consider, probably because of the planners' facility with the model being constructed. In other words, planners are able to use the model quickly and mentally integrate the partial inputs to identify key chains of developments or skeletal scenarios and suggest possible action options before all of the data are obtained.

Prior to the third and final phase, the planners completed the matrix using the partial inputs obtained from the managers and role playing (that is evaluating the remaining pairs as they think the managers would have) to obtain the rest. These results are then used to analyze the model in the usual manner to derive all important scenarios and action options.

These results were presented to the managers in a final one-day session. In that session the managers saw the cross-impact matrix for the first time. The entries in the matrix were in two colors to distinguish their inputs (obtained in our earlier session) from those which were generated by the planners. The general impression was that the planners had performed a credible job at reflecting their judgments.

The output of this effort was a significant increase in the set of candidate action options which the managers thought were worthy of more careful scrutiny before making their final decision. It was generally agreed that the results were not only useful but were obtained more rapidly and at less cost than had been the experience at Eaton before.

A key aspect in this experience is that the planners and futures researchers can and should take a more substantive role in developing the plans. They are more comfortable with their techniques than their "clients"--managers and decision makers. By cutting down on the dog work the managers have to do and by using their interpretive skills with their models, planners can help managers crystallize strategies which had eluded them before. The planning process is still more of an art than a science, and since planners practice it more, it is natural to expect them to handle the art aspects more efficiently.

However, to be really effective planning must carefully relate basic principles to the real problems confronting the corporate manager, including:

- the open-ended nature of forecasting and importance of alternatives
- different types of forecasts and degrees of precision possible
- desirability and importance of systematic procedures and maintaining flexibility in plans
- the real world fact that plans must reflect the convictions of the manager who will be carrying out the plan

In addition, planners must recognize the practical value in improving the substantive results of planning processes. By involving themselves in the activity they can measurably improve the value of the contribution of futures research.

Beyond the Stable State



DONALD A. SCHON

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5 Government as a learning system

I Public Learning

The problem of government as a learning system may be stated simply in these terms: how can we, as a society or nation, learn to identify, analyze and solve our problems?

There is more implied here than in the term social learning, as we have so far used it. A social system learns whenever it acquires new capacity for behavior, and learning may take the form of undirected interaction between systems, as in the case of 'the system for keeping us in clean clothes'. But government as a learning system carries with it the idea of *public* learning, a special way of acquiring new capacity for behavior in which government learns for the society as a whole. In public learning, government undertakes a continuing, directed inquiry into the nature, causes and resolutions of our problems.

The need for public learning carries with it the need for a second kind of learning. If government is to learn to solve new public problems, it must also learn to create the systems for doing so and to discard the structure and mechanisms grown up around old problems. The need is not merely to cope with a particular set of new problems, or to discard the organizational vestiges of a particular form of governmental activity which happen at present to be particularly cumbersome. It is to design and bring into being the institutional processes through which new problems can continually be confronted and old structures continually discarded.[1]

Phrased in this way, the problem is government's version of the more general problem of response to the loss of the stable state.

Because many sorts of social system have governments, the requirements of public learning need not be limited to traditional political units. We have already examined what we could now call public learning in the context of the business firm. The concept of public learning applies as well to institutions such as the church, labor unions, schools, hospitals, and social welfare agencies. One way of increasing the capacity for social learning of such decentralized and disconnected social systems has been to equip them with governments—that is, with agencies capable of carrying out directed inquiry for the whole; this is, in fact, a way of describing the movement toward firms organized around business systems.

In our society, however, the most visible and apparently crucial form of public learning *is* carried out by traditional political units, and specifically by the governments of nations. The material of this chapter, whatever its broader implications for public learning, will apply directly to the Federal government of the United States.

Certainly the rhetoric of recent Federal administrations in the United States suggests or directly uses the language of public learning. New administrations enter on platforms made up of lists of public problems that demand solution and policies for solving them. We are forever being exhorted to face up to our problems, to learn from our past, to be wise and persevering in our inquiry, to try new solutions—or we are being reminded that our government is doing these things for us. And this is a use of language that cuts across political parties; it is part of the stock in trade of politics. We even speak of public learning from unexpected events, as in the statement that the United States learned some things from the Great Depression.

There have been over the last decade an increasing

number of signs of concern with our capacity for public learning, for example:

- The on-going activity of the task force on reorganization of the Federal Government
- Congress's recent study of its own organization
- The efforts of the Civil Service Commission to create new categories of Federal employees with ties to the Federal Government rather than to individual agencies
- The attempt to introduce broadly across Government the system of program, planning and budgeting first developed in the Department of Defense
- During the last two presidential administrations, an acceleration in the rate of creation of new agencies, and of new interagency committees, commissions and planning groups; and within major agencies, a continuing, if fragmented, process of reorganization.

But it is also clear that as a nation we have been dreadfully inept at the process of public learning. This is not particularly attributable to a dearth of ideas for solving our problems. On the contrary, there is a plethora of suggested policies and programs for solving almost any social problem one might care to name. But we have proved ourselves—particularly in the last decade—to be singularly inept at bringing almost any new policy into effect. And we have proved to be equally inept at learning from the mistakes of the past.

The field of housing is a particularly rich mine of evidence for these assertions. Each of the last three presitential administrations has proclaimed its intent to solve the problem of housing supply, particularly for low-income citizens, and under each administration the housing situation has worsened. Moreover, there has

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been in the last thirty years a series of housing programs (public housing, urban renewal, large-scale rehabilitation) each of which turned away from the perceived failure of the old but was unable to learn from the old how to make its own operations successful.

One could as well have chosen the fields of health services, education, welfare reform, or programs aimed at the elimination of poverty. Each displays an analogous pattern. There is, to be sure, in every case an argument to be made that policies were never adequately tried because resources adequate to them were never made available. But there is also adundant evidence of lack of understanding of the means by which new policies might come into effect. And there is a prevailing attitude toward the recent past which seems to say that failures should be buried and forgotten, or that we should respond to them by a kind of over-learning which consists in veering away from the last in the series.

It is difficult to account for this systematic failure to learn, in view of the acknowledged astuteness of many of the people charged with implementing the new policies and programs. Nor does the explanation lie simply in the familiar 'good people, bad systems'. It seems, rather, to have at least one of its roots in prevailing theory about the implementation of public policy.

If we now draw back to examine the structure of public learning on the part of a specific government, we may regard it from several perspectives. It is at once an informational process, an agent of the implementation and diffusion of policies and programs, a manipulator of policies, and a complex of societies.

As an informational process, the federal government must somehow detect the issues and problems around which it organizes its efforts. It must sense the consequences of what it does. It must organize and transfer within its own system the data and the directives on which policies and programs are based. It must undertake

the 'book-keeping' tasks that go with taxation, regulation, and monitoring the state of the systems that are seen to be the legitimate business of government. Moreover, it must maintain this internal and external information system throughout shifts in its environment and in its central problems. These functions fall under what Karl Deutsch has described as the cybernetic model of government.

As an implementer and diffuser of policies, government must formulate and test out policies answering to what it perceives to be the new situations in which it finds itself, and cause these policies to be brought into effect and adapted to the range and scale of situations to which they are relevant.

In manipulating policies, the Federal Government can be seen as an operator of control systems. The 'levers' available to it are within the keyboard of policies derived from acts of Congress and agency practices. These are constantly changing, as Congress passes new laws, amends old, allocates funds, and as officials of the executive branch construct, carry out and modify policies governing administrative practice.

But the Federal Government is also a set of organizations—related to policies and programs as instruments of action; related to one another as organizational neighbors, competitors or collaborators; and related to the people in them as societies in which their working (and much of their non-working) lives are lived.

Each of these ways of looking at the Federal Government reveals a different aspect of the central problem of public learning:

- From the point of view of government as an informational system, how do new problems come to attention and ideas about them become ideas in good currency?
- From the point of view of government as an agent

of implementation, how are new policies put into action? How are they extended, modified, scaled up? And how are the interconnections between policies understood and controlled as new problems and goals present themselves?

- From the point of view of government as a learning system, how are perceptions of the consequences of action fed back into the public learning process?
- From the point of view of government as a complex of societies, how are strategies designed and carried out by which resources can be organized to attack new problems, and old structures and mechanisms discarded as obsolete or inhibiting?

The prevailing theory of public learning answers these questions in the following way:

- The forming and implementing of public policy is a rational process which takes place in the center-periphery mode.
- Issues, once mysteriously established, are taken as given. Inquiry addresses itself to the best policy for tackling an issue, but does not turn back on the relevance and apparent urgency of the issue nor on the processes by which that relevance and urgency came to be perceived.
- Similarly, government tends to act as though established policy were stable. Evaluation may address itself to the relative effectiveness or efficiency of the means by which a policy is to be accomplished but seldom (except perhaps on change of administration) to the appropriateness of the policy itself.
- The development of a new policy is sharply distinguished from its implementation. In spite of the language of experimentalism, government acts as

though the process of invention and adaptation came to an end once a new policy had been legitimized.

- Inquiry into new policy, then, is conceived as the primary responsibility of the Federal center. Implementation of policy consists in imposing established policy on a set of peripheral local agencies.
- Stable policy exists in compartmentalized units which have their parallels in compartmentalized government agencies. Once new policy has been established, public inquiry tends not to extend across agency boundaries.
- The inquiry involved in public learning is conceived in terms of the methods of physical science. Hence, we have the widespread use of scientistic language in which 'problems are defined and quantified', 'hypotheses are developed', 'social experiments are undertaken', 'variables are identified', 'controls established' and 'quantitative measures of outcome formulated'. Finally, 'demonstrations are conducted' and the successful ones are 'replicated'. The answer to the question, 'How shall we undertake public learning?' is increasingly, 'By applying what we take to be scientific method to the formation of public policy.'

Seldom is the prevailing theory made so explicit and seldom is it held in the pure form outlined above. Nevertheless, in one version or another the rational/experimental model of public learning underlies most current thought and practice in the field of public policy, and its inadequacies help to account for our failures in public learning.

It will be our business in this chapter to suggest alternatives to the rational/experimental model,[2] taking as our starting points clues provided by fragments of actual behavior.

II The emergence of ideas in good currency

Underlying every public debate and every formal conflict over policy there is a barely visible process through which issues come to awareness and ideas about them become powerful. The hidden process by which ideas come into good currency gives us the illusory sense of knowing what we must worry about and do.

We pay attention to the visible conflicts over policy; but by the time such a conflict has crystallized, issues have long since been identified, ideas for solution have long since been available, sides have been defined and taken. These antecedent processes are as crucial to the formation of policy as the processes of discovery in science are crucial to the formation of plausible hypotheses. But our bias in favor of the rational, the 'scientific', the well-formed and the retrospective causes us to disregard the less visible process and to accept the ideas underlying public conflict over policy as mysteriously given.

The less visible processes, however, are essential to change in public policy and, in general, to public learning. A learning system must transform its ideas in good currency at a rate commensurate with its own changing situation. More broadly, the adequacy of a learning system is in part shown by how far its ideas in good currency are adequate to the situation actually confronting it.

It is surprising, in the light of these considerations, how little curiosity there has been about the emergence of ideas in good currency.

Some preliminary considerations

Ideas in good currency, as I use the term here, are ideas powerful for the formation of public policy.[3] Among their most characteristic features are these: they change over time; they obey a law of limited numbers; and they

lag behind changing events, sometimes in dramatic ways.

If we take an idea's effectiveness in getting money as a test of its good currency, ideas-in-good-currency in the mid-1950s included 'competition with the Russians', 'the space race', and 'basic research'. By the early 1960s, these had given way to ideas about 'poverty', 'the disadvantaged', and 'unmet public needs'. By the early 1960s, the powerful ideas of the mid-fifties had lost their magic. In order to argue for new policies and to support requests for funds, public entrepreneurs required a new vocabulary and a new set of theories. There was a shift in the language by which people got their money. But there was also a process in which a new set of ideas began to exert its influence; in order to get or keep power, people had to serve these ideas.

The ideas of the early sixties did not simply take their places alongside the ideas of the mid-fifties. The later drove out the earlier, as though ideas in good currency in our society had a limited number of slots. But the process by which this happened was a tortuous one—so much so that at any point along the way we held ideas in good currency inappropriate to our times. City governments in the sixties, for example, failed to bring into good currency ideas adequate to the situation presented by the black center-city. The universities lacked ideas in good currency adequate to the state of mind and behavior of students.

If we take the period of the early sixties and examine ideas in good currency relating to science and technology and the Federal Government, a curious picture emerges. Among the issues taken to be critical in the early sixties and potent, at least in giving rise to Commissions and Committees, were these:

- The problem of sick industries
- Automation and its dislocations

- The scientific and technical manpower shortage
- The consequences of disarmament.

In 1963 the Kennedy Administration presented to Congress a program known as the Civilian Industrial Technology Program. Its origins and demise I have already described in Chapter 2. The program had grown out of President Kennedy's 14 points for the American textile industry, which had felt itself threatened by imports to the point that it lobbied for higher quotas and tariffs. As a way of extracting certain concessions from the industry, Kennedy offered a program of benefits, among which was Federal support of textile industry research. The CIT program took off from that point.

Over a three year period hostile forces destroyed the CIT program—in a manoeuvre that reveals a great deal about the operation of government-industry systems—but in that same period, the textile industry underwent a change. Overall demand for textiles increased, partly due to the increasing requirements of the Vietnam war and partly because of an overall increase in demand stemming from economic prosperity. It was a common joke in the industry that the textile business was like sex: when it was good, it was marvelous; and when it was bad, it was very nice. The concept of the textile industry as a 'sick industry' disappeared from the scene and with it the public sense of need for Federal research support.

In the early 1960s, the Automation Commission came into being, out of the merging of a series of concerns drawn from Congressional committees and expressed in a variety of Bills. Its title—the Commission on Automation, Economic Progress and Technological Change—reflects some of this diversity of origin. The Commission was formed on the Noah's Ark principal—two negroes, two labor leaders, two industrialists, two women, and the like—and began its deliberations at a time when the national unemployment rate stood at approximately 6

per cent. It began in a climate of deep concern about automation (sometimes used by Commission members as a synonym for technological change) and the dislocations caused by it.

During the life of the Commission, two parallel streams of events occurred. The Bureau of Labor Statistics investigated the rate of change of productivity in the United States over about the last 20 years, and revealed that (by its calculations) the rate remained roughly constant at 2·5 per cent. During the same period of time, the unemployment rate dropped from approximately 6 per cent to approximately 4 per cent.

The burning issue of automation seemed to have evaporated. The Commission produced many volumes of analysis and a wide range of recommendations—including the more recently celebrated recommendation for a national effort towards social indicators (that is, toward the development of measures of social performance, comparable to 'Gross National Product' as a measure of economic performance)—but it did not recommend a major national remedy for the dislocations of automation.

In the late 1950s, it was not uncommon in scientific and engineering circles to hear talk of the impending shortage of scientific and technical manpower. The research and development budget had been growing (at a rate which, wags said, would cause it to intersect with the GNP by 1970); defense research and development had made enormous demands on the nation's technical manpower supply; critics were already concerned about the needs of university research; and it was feared now that NASA's growing needs would exhaust the nation's remaining supply of scientists and engineers, leaving other significant national requirements unmet.

Under the leadership of Dr James Killian, a Committee on Scientific and Technical Manpower came into being, under the aegis of the National Academy of

Sciences. During the life of this committee, however, several concurrent events occurred: minor cutbacks (or rather, decreases in the rate of growth) took place in defense spending, releasing some hundreds (or perhaps thousands—the numbers were never entirely clear) of engineers claimed to be walking the streets of Los Angeles and Long Island. And students—apparently under the influence of sustained public discussion of growing demands for scientists and engineers—were alleged to be shifting toward increased enrollment in graduate schools of science and engineering.

The shortage of scientific and technical manpower did not so much disappear as dissolve. When the report of the Committee was published in the mid-sixties, its qualified conclusions did not give rise to further Federal action.

On the other hand, the problem of alleged cutbacks in defense spending—with their feared consequences for defense-based industry—became the subject of deliberation for a new inter-agency committee, whose conclussions, in turn, faded from view as the Vietnam conflict developed.

Ideas in good currency emerge *in time*, and the situations to which they refer change underneath the very process of deliberation. Not infrequently, the changes take place as a result of public debate and attention.

Ideas are often slow to come into good currency; and, once in good currency and institutionalized, they are slow to fade away. By the time ideas have come into good currency, they often no longer accurately reflect the state of affairs.

One of the principal criteria for effective learning systems is precisely the ability of a social system to reduce this lag so that ideas in good currency reflect present problems.[4] It becomes all the more imperative, therefore, to gain an understanding of the ways in which this semi-visible process works.

Themes of the process

I will not attempt here either a full-fledged theory or a complete case history. There are, however, some fairly general themes of the process which, taken together, provide a projective model against which particular instances can be compared.

The essence of the model is this:

Taken at any given time, a social system is dynamically conservative in its structural, technological and conceptual dimensions. This last represents the 'system' of ideas in good currency. Characteristically, what precipitates a change in that system of powerful ideas is a disruptive event or sequence of events, which sets up a demand for new ideas in good currency. At that point, ideas already present in free or marginal areas of the society begin to surface in the mainstream, mediated by certain crucial roles. The broad diffusion of these new ideas depends upon interpersonal networks and upon media of communication, all of which exert their influence on the ideas themselves. The ideas become powerful as centers of policy debate and political conflict. They gain widespread acceptance through the efforts of those who push or ride them through the fields of force created by the interplay of interests and commitments. Inquiry now becomes a political process in which the movement of ideas to power goes hand in hand with bids for dominance. When the ideas are taken up by people already powerful in society this gives them a kind of legitimacy and completes their power to change public policy. After this, the ideas become an integral part of the conceptual dimension of the social system and appear, in retrospect, obvious.

Crisis There is, to begin with, some critical shift in situation which threatens the social system and sets up a demand for new ideas which will explain, diagnose or remedy the crisis. The analogy with scientific inquiry is

helpful. The 'crisis' here is a piece of disruptive evidence incompatible with accepted theory which for some reason cannot be ignored. The Michelson-Morley experiment concerning the speed of light was a famous case in point, as was Galileo's observation of the mountains of the moon, Ticho Brahe's observations of the orbits of the planets, the recent discoveries of multiple subatomic particles, in Darwin's time the geological data concerning the age of the earth. Each of these confronted the scientific community with the failure of accepted theory and raised the potential for new ideas in good currency.[5]

There is a social system of science, underlying its visible theoretical dimension, and there is conversely a theoretical dimension to every social system which contains the social system's view of itself, its role and function within some larger system, the nature of its environment, its own operation, and the norms which govern its behavior. As in the case of scientific theory, then, a 'crisis' for the social system is any happening perceived to be incompatible with this prevailing theory.[6]

But, as we have seen, dynamically conservative systems normally protect themselves against ideas which cannot be brought to public attention without disruptive consequences. Think, for example, of the history of the concepts of psychoanalysis or of the welfare state, or indeed of any set of ideas perceived as threatening prevailing institutions. The means of protection vary. Ideas may be relegated to private spheres or to the margins of society. Where ideas have not yet penetrated the general consciousness but suggest themselves on all sides, they may be repressed—that is, held back from conscious attention—or, like ideas discussed under headings such as philosophy or change, they may be relegated to a kind of intellectual never-never land, disconnected from action. Where ideas have become subjects of explicit attention, at least on the part of a few, those people may be suppressed, forcibly prevented from entering the arenas of

public inquiry and debate. The movement from repression to suppression[7] is a characteristic pattern in the emergence of ideas in good currency; as the ideas become more powerful, the defense against them shifts.

Events come to function as crises in the sense used here only when forces working toward the perception of them somehow overcome these protective mechanisms. For American society at large, the war in Vietnam is such an event, as is the revolutionary behavior of a large part of American youth. These events disrupt not only by rocking the boat of civil order but by jarring settled ways of looking at society.

Such a disruption does not immediately overturn established theory. There is usually a substantial lag between perception of the disruptive phenomena and reorganization of prevailing theory. The lag may be counted in months, years (as in the case of the ideas relating to policy for science and technology) or decades. Gradually, efforts to ignore or repress the crisis give way to a realization of its existence, its incompatibility with settled ways of looking at things, and its danger to the social system. At this stage, there is widespread readiness for new ideas.

Attention turns then to certain free areas within the social system. These are backwaters in which ideas have been able to germinate without encountering massive defenses. They are the margins of society. Freud, for example, during the time he was working on *The Interpretation of Dreams* existed, in the medical and the larger social worlds of Vienna, as a marginal man. Norman Thomas occupied a marginal position in American life for decades until his ideas (not his person) found their way into the mainstreams of public policy.

The social system tolerates, to a greater or lesser extent, in marginal areas or in playful or innocuous form, or in relatively insulated groups, ideas which would be virulent and disruptive if released into the main arteries

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of the culture. Then, crises in the system permit or compel these ideas to come to public notice and to begin their progress toward public awareness, currency, and acceptance. Ideas about mystical experience, communes and enhancement of experience through drugs survived in the United States for generations in small sects only to be taken up in a massive and public way in the sixties. In the forties and fifties, radical critiques of America's poverty, decaying cities, and neglected needs in the public sector, survived in a submerged and compartmentalized way to emerge in the sixties as broad-based critique and (in the Kerner Commission Report) as public gospel. Throughout America's sexually conservative years, liberal attitudes towards the human body survived in relatively invisible enclaves because most people were able to regard their adherents as cranks. In the sixties these attitudes emerged as a powerful threat to established morality.[8]

Vanguard roles The movement of ideas from free areas to the mainstream has nothing automatic about it. Ideas do behave as if they had a life of their own, but only through the efforts of those who use and are used by ideas. Vanguards move ideas to public awareness, supplying the energy necessary to raise them over the threshold of public consciousness. But within and among these vanguards, there is a multiplicity of roles.

The muckraker forces us to look at the disruptive instance, takes it out of the domain of private experience and thrusts it into broad public view as Michael Harrington did for poverty in America, Robert Coles for hunger and desolation in the Mississippi Delta, and Ralph Nader for the abuses of the manufacturers of consumer products. The muckraker is like the scientist who forces the scientific community to pay attention to a piece of evidence incompatible with prevailing theory.

The artist gives us new ways of looking at our experience, new ways of defining ourselves in relation to reality,

and in the process frees our awareness of phenomena incompatible with settled theory. In Marshall McLuhan's language, he shifts our gaze from the 'rear view mirror' to experience of the here-and-now, as Cubism gave us a vision of things in the image of the new industrial forms, or as James Joyce helped us to become attentive to things in our own experience that depth psychologists were at roughly the same time beginning to explain.

The utopian presents us with a vision of what might be, in such a way as to focus attention on the inadequacy of what is—either directly, by contrasting a better future with an inadequate present, or ironically, by presenting as future a concentrated picture of present evils. Bellamy in *Looking Backward* and Skinner in *Walden II* were primarily in the first mode, while Orwell in *1984* and Vonnegut in *Player Piano* were primarily in the second.

The prophet—whether in his Old Testament form or in the current ecological style—tells us where we are going, makes us treat as real and present the distant consequences of our current behavior, and through appeal to morality confronts us with sins we would otherwise have ignored or repressed.

The vanguard roles need not be mutually exclusive, of course. Samuel Butler was both prophet and utopian. But the nature of the vanguard roles and the crises to which they call attention vary with the type of idea in good currency.

The idea may be a way of looking at a particular situation, one that has implications for public action: for example, the pricing policies of the drug industry, the condition of mental hospitals, hunger and malnutrition in rural America. Then the crisis is a particular event, practice or institution incompatible with prevailing theory, and the muckraker's role is primary.

Or the idea may be in the nature of an invention. In this case, the *idea* of the invention undergoes a process of coming to awareness, diffusion, debate and acceptance

which is at once distinct from and interdependent with the innovation and diffusion of the invention itself. The crisis may be a particular inequity to which the invention is a response; the scandalous condition of mental hospitals, for example, led to the invention of community mental health centers. Or it may be a disruption of some functional system; automobiles changed patterns of settlement and access to the center city, and the suburban shopping center has been a responsive invention. The important vanguard role here is a kind of prophet; Buckminster Fuller, with his 'Dymaxicon' car and house, has been a prophet of technological change.

The idea may be in the nature of intermediate theory, theory that serves as a bridge connecting views of particular situations to what we will later call paradigms of change. The bridging function of intermediate theory is essential to public learning. For those who operate under a revolutionary paradigm in a particular community, there must be a theory of the community that connects it to the paradigm. If the paradigm requires 'establishment', 'disadvantaged', and 'community leadership', then an interpretive process must identify these elements within the community. Otherwise the paradigm cannot engage the community situation. A man like Saul Alinsky plays in communities like Chicago's Woodlawn district the role of formulator and purveyor of such an intermediate theory, whose function is to connect Woodlawn to the paradigm of revolution. He is at once muckraker and utopian, and the crisis to which he responds has its roots in the discrepancy between the reality of communities like Woodlawn and the prevailing norms of equity in our society. Without such a connection the paradigms have no potency, no matter how strongly they are held.[9]

Within the theoretical dimension of a social system, ideas operate at different levels. At the most fundamental level, every social system has root concepts which underlie all theory-making. These are in the nature of metaphors

like mechanism, technique and progress which in the last several hundred years have cut across most sectors and subcultures of society. As new root concepts move into good currency their influence on the larger social system is enormous, since they influence not only a particular public policy, practice or situation, but the entire range of activities and practices of the system as a whole. These root concepts are like the largest overriding waves of change. They overshadow the smaller perturbations due to innovations related to particular institutions, inventions, or pieces of intermediate theory. The vanguard roles associated with root concepts are those of artist, scientist, philosopher, whose contribution is to make us alter our most fundamental views of things; and the crises to which they respond are the disequilibria associated with the deepest patterns of structural, theoretical and technological change.

Where 'idea' may have four such disparate meanings, not only the nature of the vanguard roles and related crises but the time-scales for emergence in good currency must vary enormously. Alinsky's ideas about Woodlawn began to penetrate Woodlawn itself in less than a year. Ralph Nader's views of the abuses of the automotive industry came to public awareness in about five years. Buckminster Fuller's technological prophecies took over twenty years to reach national attention. The time required for the development of widespread awareness of the cluster of theories associated with mechanism or progress must be numbered in half-centuries.

Diffusion of ideas The creation of widespread public awareness demands the diffusion of ideas, a process distinct both from the process by which ideas become powerful and from the diffusion of the practices to which ideas relate. At the time of this writing, for example, the ideas of certain inventions—the electric car, the environmentally controlled city, the programmed transportation system—begin to diffuse broadly throughout society,

well in advance of their becoming powerful for public policy and well in advance of the widespread adoption of the inventions themselves.

In this process, media are central. They are the vehicles of the vanguard roles, the technologies of diffusion. They have their own thresholds and place their own criteria on the formulation of ideas to be diffused. These requirements are not merely technical. There are journalistic requirements that events fit the prevailing myths of news. There are semantic requirements for 'catchiness'. The very ability to express an idea in a phrase—Medicare, the War on Poverty, Guaranteed Annual Wage—may be critical. Through such requirements, media transform the ideas themselves.

The brokers of ideas, equally important to diffusion, adapt and translate ideas as they pass them along from one sub-system to another or from a sub-culture to the larger society. They are consultants, popularizers, interpreters, critics and analysts whose brokerage channels are the informal networks that connect segments of society to one another.

In general, the pattern of diffusion is neither straightforward nor homogeneous. Ideas are waves that engulf broad areas of society, but they do so unevenly depending on the susceptibility of subcultures to *that* idea (Women's Liberation, the Ecological Crisis, Guaranteed Income) and on the varying permeability of subcultures to new ideas in general. This difference in permeability to new ideas defines subcultural boundaries and, again, exerts its influence on the ideas themselves.

Struggle for acceptance When an idea gains public attention, it does not thereby become potent for change in policy. Its power is manifest when it is not only broadly recognized and publicized but when it has become an issue for debate, when organizations begin to grow around it, and when it begins to be used to gain influence and money.

Ideas—concerning, for example, the legalization of marijuana or abortion—may become powerful for public policy long before they gain broad acceptance. And ideas may gain power as well as attention for one group before another. The differences in the relative potency of ideas such as 'establishment', 'elite', 'progress', 'success', 'social justice', 'equity', 'minorities', 'racism' and the like, go a long way toward defining the oppositions in our society between black and white, young and old, radical and liberal. What we find to be ideas in good currency, then, depends on whether we examine family, friendship groups, organizations, neighborhoods, broad subcultures (like 'black culture' or 'youth culture'), the nation as a whole or the vast and nebulous entity called 'world opinion'.

If ideas are to become powerful for change in policy, they must enter a field of competing forces. To the extent that ideas enter channels leading to public consideration in such a way as to threaten a social system, they stir up conflict, formal or informal. At this stage in the emergence of ideas in good currency, there is a central place for the roles of champion and defender.

The short but instructive career of the 'COMSAT' for Housing illustrates something of these roles and their interactions.

During President Johnson's administration the Department of Housing and Urban Development (HUD) held a summer conference on Science and the City. Out of this conference came a design for a national quasi-public institution, modeled on the Communications Satellite Corporation, to tackle massive low-income housing goals.

COMSAT for Housing had a champion, Hortense Gabel, who, in order to develop the idea, assembled a team of architects, planners, systems analysts, and housers. She pressed for the idea's acceptance, formally and informally, through successively higher levels of HUD.

She succeeded in organizing presentations and reviews for the Undersecretary and Secretary. Not surprisingly, she produced mixed results. Partisans and opponents of the idea emerged within the hierarchy. Partisans battled to overcome internal opposition and bring the idea to the attention of the White House staff and finally to the President.

Opponents argued over the idea's workability, its impact on the housing industry, its centralization of power. But underneath the surface of the argument, attack and defense reflected personal enmities and alliances and concerns about dominance or devotion. The idea engaged HUD. It split the organization into parties according to intellectual and ideological positions, political and personal interests. In this context, the champion presented the idea in its most favorable light, talked to each advocate or defender in the terms of his greatest interest, built alliances, made judgments about the timing of confrontations.

Thanks to these manoeuvres, the idea made its way to the White House and seemed about to gain acceptance as administration policy until a leak to the *New York Times* caused President Johnson to withdraw his support. The idea continued to exert its influence, however. Elements of it have found their way into other housing proposals and into some ongoing programs.

The story of the COMSAT for Housing has parallels in thousands of comparable efforts to introduce new ideas into situations where they will effect change in public policy. It is comparable in some ways to the history of the Civilian Industrial Technology Program or to the Automation Commission. As creation of awareness and diffusion of concept give way to the effort to gain acceptance, a new sort of game begins to be played. Attack and defense, championship and resistance, become the dominant modes. The fields of force within institutions condition the moves and their outcomes. Failure to win the

game in a particular institutional battle does not, of course, condemn an idea to permanent rejection. Ideas lend themselves to repeated battles as changed political situations offer new opportunities. And even when an idea dies in a particular form, it may continue to influence succeeding ideas, as the idea of the COMSAT itself influenced the formation of the COMSAT for Housing.

The three previous sections support the distinction between the processes by which ideas come to awareness, diffuse and gain power. But these processes also interrelate. The diffusion of an idea like COMSAT made it easier for a COMSAT for Housing to surface in HUD. *That* idea spread as it became a center of controversy and gained acceptance. In fact, the two processes fed on each other; diffusion led to conflict and conflict nourished diffusion.

Invasions Given this warlike process, it is not surprising that ideas in good currency change as one social system invades another. In combat with the dynamically conservative system, the invader replaces the internal champion. Ideas (or systems of ideas) move, through invaders, into the invaded culture, transforming as they go.

As they cross cultural boundaries they take on the character of metaphor. As lawyers in the last decade became increasingly involved in representation of the poor, 'advocacy' found its way into 'advocacy planning', 'medical advocacy', and the like. Legal advocacy became a projective model for new kinds of relationships between citizens and professionals. The concept of 'ombudsman' travelled a similar path. The biological concept of ecology invades planning and urban studies. In each case the idea transforms itself as it shifts from one field to another. The 'ecology of the city' is not an ecology in the biological sense, and 'advocacy planning' is in many ways unlike legal advocacy. But the idea from the donor culture serves in the recipient culture as a

nucleus for the evolution of a new idea in good currency.

Politics of inquiry Whether it occurs through internal championships or invasion or both, the struggle of ideas in good currency to gain acceptance has not only an intellectual but a political dimension. In order to gain acceptance ideas must tap into sources of power. They are also vehicles through which persons and agencies gain power. When individuals push or ride ideas they also seek to establish their own dominance.

It is interesting to consider the process through which a small group moves as it tackles and begins to resolve a relatively unstructured problem. Leadership, if it is there, shows itself in the way ideas move into good currency, in the championship or defense of ideas, in nurturing the process of problem-solving. If leadership is indeterminate, it may develop through the problem-solving process itself. Characteristically, ideas, perspectives and solutions compete, and in the same process ideas and persons emerge as dominant. It is as though the struggle for authority were a facet of the problem-solving process. There is here, perhaps, the seed of an explanation of the law of limited numbers.

Within a social system at a given time there are never very many ideas in good currency, just as there are never very many fashions. It is as though a social system had for ideas in good currency a limited number of slots. This law of limited numbers clearly has one basis in our limited ability to absorb and tolerate ideas. It has another in the fact that potent ideas make incompatible demands on time, energy, and resources. But there are, in addition, limits to the 'role slots' for leadership. If ideas come into good currency through a process in which some people come to dominate others, we can understand why there is at any given time in a social system a limited number of slots for powerful ideas and why powerful new ideas drive old ones out.

Legitimization Ideas need finally to be legitimized if they are to become embodied in public policy. If ideas are to gain entry to the limited set of channels through which formal policy changes flow, they require, in the approval of administrators, commissions, notable personages, legislators and the like, a kind of benediction. The benediction is essential and it is seldom automatic. Those who can confer it use their authority as scarcely as Congress uses its power of the purse. The decision to grant it springs ordinarily from a shared calculation of the idea's relation to personal and political interests and of the power it has already amassed. The refusal to grant it may kill an idea, at least for a time and in a particular form, as in the case of the COMSAT for Housing. The decision to grant it later may produce, as in the case of the 'technical manpower shortage', the absurd effect of a newly legitimized idea clearly out of step with its times.

Systems of ideas Ideas often travel not alone, but in pairs, clusters or systems. Often it is difficult to determine where one idea leaves off and another begins, and therefore to apply the law of limited numbers.

In recent American experience, for example, the notion of community control is a theme with many variations, not all mutually compatible. The movement to community control turns out to be composed of many sub-movements differing in goals, strategy, and style.

At any given time, ideas in good currency may form a system, a set of compatible and mutually reinforcing ideas related to one another as interlocking aspects of a single policy. More likely, a set of differentiated notions —like 'community-based health center', 'children's center,' 'headstart,' 'neighborhood health center'—represent variants of a single theme—decentralization of services—which, at a quite general level, is in the air. Ideas like 'advocacy', 'ombudsmen', 'COMSAT', may pop up in agency after agency or in segment after segment of policy not through a concerted effort at diffusion,

but through independent efforts to latch on to an idea of emerging potency. Such as idea may seem to burst full-blown on the scene, as 'ombudsman' did in the mid-sixties, or it may emerge through a kind of mimesis out of a variety of generalizations from specific situations, projects, demonstrations, presentations, experiments and the like.

Whether ideas in good currency take the form of a system, or of a theme and variations, they unquestionably reveal, at any given time, a family resemblance which testifies to the overlapping and mutually interactive processes by which they came to be.

At bottom, this family resemblance may stem from the environmental, technological, economic and class-related conditions of the society. We cannot separate the theoretical dimension of a social system from its structure and culture.

The purpose of this analysis, however, has been to suggest that the emergence of ideas in good currency, as a process, has certain characteristic features, regardless of the content of the ideas in question and regardless of the conditions from which they spring.

Responses to the pathologies of ideas in good currency It is tempting to argue that reform of the process through which ideas come into good currency must consist in elimination of the non-rational factors—that is, of anything that detracts from simple awareness of the troublesome features of situations confronting the social system. But this is neither possible nor desirable.

For one thing, the issues taken to be important at any given time represent a selection from a total body of information which is of enormous complexity. The inventory of issues in good currency is never adequate to the situation; it never succeeds in exhausting what might be the set of issues to be drawn from that situation. The ultimate basis of this fact is epistemological; there is simply more in the situation than can be conceptually

abstracted from it. Because one never comes to the end of listing the issues inherent in the situation, there must be some basis for selection. The selection cannot be made on the criteria of 'what is most important', because this would imply a complete inventory of available issues, from which the most important were to be selected; and such a complete inventory is not feasible. Issues can indeed be selected as important, on some criteria, but there is a level of arbitrariness here, because other issues, equally important, might also be selected. The political meaning of issues—their relation to the effort to gain or keep power—aids in the process of selection. The politics of inquiry is endemic to the emergence of ideas in good currency.

But there are pathologies of the process that lead to inertial life and to premature abandonment of issues. These are protected by the scientific mythology under which we treat the issues as given, and cut off from inquiry the process leading to their emergence. The given-ness of ideas in good currency is, in effect, a variant of the myth of the stable state.

There is also our need for a façade of progress and problem-solving. Government seems to need to operate always under an aura of rational, active work on what are taken to be public problems; and, moreover, to be perceived as making progress in that work. This has the effect of inducing premature abandonment of issues. If we are not solving them, we must at least give the appearance of progress by moving on to the next batch. It tends to be true of government, as of philosophy, that old questions are not answered—they only go out of fashion.

Often these myths are coupled with the further myth of 'once-and-for-all' solutions—the belief that we can come to the end of the problems to be dealt with. Hence, the language, for example, of 'elimination of poverty', when it is quite clear that poverty is a relative condition which

behaves on a kind of Maslow-scale, needs fulfilled simply leading to the clear and present perception of further needs requiring, with equal urgency, to be met.

And there are certain related pathologies of the process which tend to keep government from knowing what is happening, even when it has no clear political interest in avoiding this knowledge. In their resultant effect, these myths and pathologies lock government into issues that have been identified, or they induce it to move on to the next issue while the old ones remain equally urgent and unresolved. Although the politics of inquiry cannot be dispensed with, its pathologies are intolerable in an era of loss of the stable state.

While the remedies are unclear, we can identify some directions in which to reach for them:

- *Increased public attention to the process by which ideas come into good currency* The pathologies described above depend upon the obscurity of this process both to the general public and to much of government. Reform requires, first, recognition that there is such a process and that it is susceptible to certain kinds of influence. The nature of that influence may itself become a political issue of importance.

- *Support of the vanguard roles, of marginality, of brokers of ideas* Given our analysis of the process by which ideas come into good currency, any concern over helping the process must address itself to key actors within it. And these key actors tend to occupy roles in the free areas of society, to be marginal in relation to established systems, or to occupy the vanguard roles of prophet, muckraker, artist and critic. It may be futile to call for increased support by established interests who find themselves threatened by the very roles in question. But there is enough difference of perceived interest on the part of many of the institutions capable of

such support to permit increase in the overall level of support.

- *Reform of the design and implementation of the process of evaluation* as it affects determination of the relevance of issues and of policies designed to deal with them.
- *Modification of elements of the social system of government* in order to counter forces which support the inertial life of ideas in good currency.

The last two points will be discussed in later sections of this chapter.

III Implementation of policy

Ideas powerful for action may lead to the formation of a policy and then to its broad application. The problem of carrying out a policy is in many ways a version of the diffusion of innovation, a version in which the innovation is a new policy and the agent of diffusion is a government. It is not surprising, then, that in the dominant, center-periphery model of policy implementation, 'central' first defines a policy and then takes responsibility for spreading it.

The center-periphery model of the implementation of policy may take a variety of forms, depending on the level of specificity at which the new policy is initially defined, the role of central, and the ways in which behavior at the periphery is sanctioned and monitored.

1 *Promulgate a policy* Here, central simply sets forth the policy it desires—for example, the restriction of business investments abroad, or the involvement of business in ghetto problems. There is no invoking of sanctions, no monitoring for compliance, and no provision of resources from a central agency. It is assumed that the simple exhortation to behave in a certain way will elicit the desired behavior.

2 *Seed demonstrations* Central creates first instances of the desired behavior and assumes that others at the periphery will imitate them until the new policy has spread adequately over the territory.

3 *Provide teachers* Central defines the new policy and then provides teachers, trainers or consultants to assist local agents in carrying it out.

4 *Provide resources* Central defines the new policy and provides the resources it believes necessary for implementation. These may take the form of money, or more specific forms such as contraceptives for birth control or fertilizer for farming. The new policy may be defined at a high level of specificity and the resources given directly to implementing agents. Or the new policy may be defined only in very broad terms and the resources given to intermediate agents for their further distribution; in this case the model approximates to block grants and revenue sharing. In both cases, it is assumed that local agents know how to carry out the policy, or can learn; that they will want to carry out the policy without compulsion; and that they are prevented from carrying it out by the absence of resources which they cannot be expected to get for themselves.

In each of these models, central avoids sanctions or monitoring and takes only those initiatives required for local agents to learn the new behavior. Each model represents a different view of the required initiative.

5 *Enforce the law* Here it is assumed that local agents will know how to do what is desired and will not want to do it. Policies are promulgated in the form of laws and systems established to monitor and enforce compliance. The policy may prohibit certain kinds of behavior (drunkenness, for example) or it may command positive behavior (maintenance of property to standard). Punishments may vary from imprisonment to the withdrawal of funds. In each instance, it is assumed that central need provide no resources or teachers, and that the threat of

punishment will be enough to induce and sustain the desired behavior.

6 *Extend central control into the periphery* Action cannot be left to local agents, regardless of the nature of the sanctions or the supports provided. In order to produce the desired behavior, central must incorporate the local agents into its own organization. Central's relation to local agent now becomes that of central to regional office or of grantor to grantee. Resources, teaching support and sanctions may flow from central to the local agents, but always within the framework of central's administrative control.

The six center-periphery models of policy implementation are types, amenable to many different combinations. Teachers and resources may be provided together, for example, or combined with demonstrations or with punishment for non-compliance. Different models may be applied to the several phases of policy implementation. One model may be used to generate plans, for example, another to produce first instances of action and yet another to maintain long-term behavior. The use of particular models or combinations will reflect judgments about key assumptions—whether new behavior can be elicited from local agents, independent of central; the extent to which central must keep local agencies under continuing control; the disposition of local agencies to behave according to the new policy; the means by which a central agency can induce or control behavior in many local agencies; the resources available and needed to carry out the policy; the stance central takes in relation to local agents; and the nature of existing systems in the localities for implementing policy.

All of the center-periphery models and their combinations share, to a greater or lesser extent, the assumptions that policy exists fully defined prior to its implementation; that policy is to be applied uniformly in all localities, at least in broad outline; and that management of the

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process of implementation belongs, in critical ways, to central. All of the models rest on theories of learning; they depend on certain beliefs about the ways in which central can induce local agents to behave in conformity to policy. Each model lends itself to distortion in practice just to the extent that its assumptions and theories do not hold.

Propose-dispose

There is a particular version of the center-periphery model, broadly and powerfully held at least in the United States, in which central formulates specifications for a new policy, makes funds available for its implementation, and solicits proposals from local agents for behavior conforming to the policy. Central then rewards certain proposers with funding, punishes others by withholding funds, and proceeds to monitor the behavior of local agents for conformity to proposal. Withdrawal of continued funding is the sanction invoked to enforce compliance. There is sometimes the further notion that the local agents will, after a time, secure their own resources to continue implementing the policy.

The attraction of the propose-dispose variant lies in its intermediate position between tightly coupled and loose, non-controlling relationships between center and periphery. The model recognizes that central cannot or should not assume the role of local agent, and that compulsion alone will not be sufficient to induce the desired behavior. It solicits the desired behavior, therefore, but introduces an element of compulsion through the carrots and sticks represented by the granting or withholding of funds. The model also represents an approach to the generation of new policy. Where central can specify the broad outlines of the desired behavior but cannot describe it in detail, it may ask local agents to fill in the blanks.[10]

In the propose-dispose model, central does assume

that many local agents can be stimulated to behave in accordance with central policy through the promise of reward and the threat of punishment. In this sense, the model rests on a behavioral theory of learning which has been associated with the names of Pavlov, Watson and Skinner: the trainer first elicits behavior by setting up a situation in which the subject is moved, by fear of punishment or hope of reward, to improvise; the desired behavior is then selected and progressively stamped in by continuing reward, while punishment eliminates undesirable behavior. When it is applied to the broad implementation of policy, the propose-dispose model raises the special problem of a government 'trainer' who must somehow train at a distance a large number of dispersed subjects. It is as though Skinner were to train a thousand pigeons widely dispersed throughout the country.

At each step of the process, the propose-dispose model depends for its effectiveness on certain additional assumptions:

- It is feasible for central to generate broad new policy which will be applicable to many dispersed localities.
- It is possible to stimulate an adequate number of conforming proposals by disseminating central specifications coupled with the promise of monetary reward.
- It is feasible and economic to control widely dispersed local behavior by some form of monitoring and enforcement.
- Local behavior will continue to conform to the proposal after the monitoring period is over.

We can explore the validity of these assumptions, as well as the more fundamental set of assumptions which go to make up the rational center-periphery theory of

policy implementation, in the context of a particular Federal program.

The State Technical Services Act

In 1965, Congress enacted a bill called the State Technical Services Act, whose stated purpose was to increase industrial productivity by disseminating advanced technology throughout American industry. The Act recognized that large industry tended to be more effective in its use of new technology than small industry, defense-related industry more effective than civilian industry, and industry close to the big cities more effective than industry in less populous areas. The Act aspired to equity in the use of new technology. It sought to cause new technology to flow into industries and geographical areas relatively poor in technology.

The Act assumed that a kind of technological vacuum existed in certain companies, industries and regions, and set out to fill this vacuum by forging bonds between industry and the universities.

In this respect, the Act was a version of a very old idea. The first Morrill Act, which launched the Agricultural Extension program, also included an Industrial one. It called for the establishment of industrial experimental stations, industrial extension programs in the Land Grant Colleges, and industrial extension agents, all parallel to the agricultural extension model. But the industrial side of the Morrill Act remained substantially unrealized. In the hundred years between the Morrill Act and the mid-1960s, union proponents unsuccessfully advanced about twenty different versions of the industrial extension program.

The generation of the State Technical Services Act was itself a complex process which lasted well over two years.

At the time of the drafting of the Act, there were about fourteen local programs in State and Land Grant

institutions which served as prototypes for what might be done under State Technical Services. Their activities included consultancy, technical assistance, trouble shooting, short courses, and the dissemination of information; and their clients tended to be small firms located in relatively non-industrial States, such as Georgia, North Carolina and Missouri. They supported the new bill.

But there were many other actors involved in the process that led eventually to the bill's passage:

- The powerful Land Grant College Association. It wanted to capture the program in order to build up established departments of university extension.
- The agricultural colleges and the agricultural extension agents associated with them (some 70,000 of them still in the field in 1965). Agricultural extension, feeling many of its traditional functions slipping away, saw in the program an opportunity to diversify into growing sectors of the economy.
- University libraries and technical librarians and the multiple associations to which they belonged. These saw in the program an opportunity to build libraries and instal new methods of processing information: they saw the process of technological innovation and diffusion as a problem in information-dissemination.
- Industrial development agencies in the various States, and their associations, who saw industrial development as a matter of attracting industry to new State locations.
- Some State Governors, particularly those from rural States, saw the program as a politically attractive contribution to economic development, were anxious to receive their share, and felt strongly the need to counterbalance the trends of move-

ment of investment and industry toward the large centers of population.

- Within the Federal Government itself, there were interactions with the Department of Agriculture, the Council of Economic Advisors, the Economic Development Agency, the Small Business Administration, the Bureau of the Budget, and the office of the President's Science Advisor. The last two played the role of mediator of the conflicts engendered by the program.
- Business organizations, such as the Chamber of Commerce, and national professional and engineering organizations, who saw in the program a potential threat to free enterprise and to the hegemony of large corporations, or who felt it was simply another Federal boondoggle.

The effort to get the legislation passed was very much a process of manoeuvring among these actors, whose interests conflicted and overlapped. In the process, the Act was shaped in a way that gave a high degree of control to existing State organizations, such as State Universities and Land Grant Colleges, and made for an equitable distribution of monies among the States, with a preferential attitude toward the less populous and industrialized. These elements reflected the need to please senators from the rural States. In addition, the program veered away from anything that looked like product development or technological innovation; this was to counter opposition from private industry. The Act leaned heavily in the direction of teaching, technical assistance and the dissemination of information.

In the months immediately following the passage of the bill, the Department of Commerce solicited proposals for projects which were to be pilots for the broader program. Universities, colleges and independent non-profit institutions submitted proposals, of which only a limited

number could be funded. The great bulk of proposals were from university departments of extension and from university libraries. These proposed, for the most part, to continue what they had already been doing, even though their short courses and dissemination of documents were precisely what had *not* made significant contributions to the industrial use of advanced technology. Many of these proposals were rejected with the comment that they were not sufficiently innovative in their approach to the problem. Back came proposals with a veneer of innovative rhetoric, covering essentially similar content.

An advisory committee had been formed, incorporating representatives of many of those institutions that had supported the bill. Representatives of the Land Grant Colleges, State Universities and libraries all pushed for support of their institutions in the first batch of proposals to be funded. It was judged important to 'set the tone'.

The Department of Commerce, which had responsibility for the program, eventually funded proposals which seemed to be a compromise between innovative and more traditional activities. It then devoted its efforts to developing new proposals, which would take points of view different from those of earlier proposals, and to monitoring which would make the universities live up to what they had said they would do.

In the meantime, there arose the problem of finding a permanent director for the program. The conflict of agency interests surrounding it made the position seem precarious to many of those to whom it was offered. Eventually, it went to one of the more attractive candidates put forward by the Land Grant College association. Over a period of two to three years, most of those originally associated with the generation of the program had left the Department, and there was a marked reduction of the tension between those proposing and those disposing.

In this example, we can see a number of principles at work.

The processes of forming and implementing policy were both political processes, in which national and local interests expressed themselves. The constellation of those interests and powers set the framework within which the propose-dispose process took place. The effort to establish innovative policy met the resistance of established institutions, some of which tried to defeat the program and others to co-opt it. Because of the tortuous process of policy formation, which required many interconnected steps of approval and reformulation, and because federal agencies were swayed by powerful forces outside the government, established institutions were able to build their interests into the policy itself and into the mechanisms of implementation. When the policy came to be implemented under the propose-dispose model, these same interests re-expressed themselves in the proposals of local agencies. It was as though these interests had been compressed in the policy and expanded again in the process of implementation.

Under these conditions, the propose-dispose model lends itself to a kind of game. Central and local agencies take different roles and perspectives. For central, the propose-dispose process is a means of selecting local agents and stamping in behavior congruent with central policy. For the local agents, the process is a ritual performed in order to get money to carry out their own objectives.

There is always a tendency for federal funds to be drawn away from the goals of central policy and toward the actual goals of local agencies. And there is a countertendency on the part of central to force the funds back into channels conforming to central policy.

Within such a framework, there are predictable moves and counter-moves available both to central and local agencies.

- Central

  Set up a competition among local agencies, among regions, among individuals, so as to increase central power of selection and action.

  Conceal the amount of funds available, so as to heighten the competition.

  Employ independent people to evaluate and monitor the local agents, so that they act as levers on them.

  Employ the threat of cancellation or non-funding. This must stop short of the point when a substantial number of subjects become unwilling to play (after all, if they all stop playing, central loses).

- Local

  Propose what central wants to hear, but do what you want to do.

  Develop a rhetoric compatible with central policy.

  Play funding agencies off against one another.

  Seek minimum federal control over the use of money.

  Take advantage of a surplus of information about what is going on at the local level, and the high cost of finding out for central.

  Bring pressure to bear on the funding agency, exploiting its political insecurities.

  Attempt to gain central's commitment over time, so that it develops a heavy investment in the local venture and finds it difficult to back out.

Broad new central policy is not applicable, *per se*, to many dispersed localities. There are real differences be-

tween the perspectives and interests of local agents. Further, the very process by which new central policy comes into good currency makes it lag behind local perceptions of real issues. Where the relevant situation is changing fast, the first perception of the change is apt to be a local one. The process of central policy formation tends to consist in a compression of diverse and conflicting interests which come unstuck again at the local level. Each policy then becomes a projective test for local representatives of divergent interests, each of which sees in the policy what is enhancing or threatening to it. Finally, central has a vested interest in seeing that policy is implemented uniformly, since this permits its administrative mechanisms to work, whereas the essence of local interests is diversity.

The disparities between central and local agent which undermine the propose-dispose mode of implementing policy have their roots in the same sorts of disparities which cause the failure of center-periphery systems for the diffusion of innovations. To these inherent distortions central may contribute confusing specifications of policy, reflecting incompletely resolved conflicts of agency interests. Or central may monitor in a way that increases the evasive action practiced at the local level, so that more and more of the available energy goes into the attempt to exercise, and then to escape, control.

If the argument to this point is sound, it follows that the other models of central implementation of policy will not escape these distorting forces. So long as the model assumes the prior establishment of central policy which is to be spread uniformly through local systems, distortions will arise in practice.

- The models which do not monitor or impose sanctions may avoid the investment of energy in game-playing, but may yield inaction.

- The legal model may yield no change, least change or a game of efforts at compulsion and evasion.
- The extension of central organizations into the periphery may simply internalize the conflicts between central and regional elements.

The example of the State Technical Services Program displayed some of the pathologies of the rational, center-periphery model. The following example suggests an alternative approach to policy implementation.

The Regional Medical Program

In the mid-1960s a Federal Commission, headed by the Houston surgeon, Michael DeBakey, proposed the initiation of a national program devoted to heart disease, cancer, and stroke—sometimes called the 'Congressional diseases'. Central to the program was the notion that advances in medical technology—for example, open heart surgery and intensive coronary care—had not spread beyond the great medical centers. The Commission wished to promote their equitable distribution.

To this end, it adopted what came to be known as the DeBakey model, a system for the regionalization of medical care which linked to every center of medical teaching and research a periphery of community hospitals and practising physicians. Through the dissemination of information, continuing education, training, and the deployment of specialized facilities for care, new medical technology was to flow outward from the medical center. The role of 'central' was to distribute resources (about 100 million dollars), and to oversee and control the diffusion of the DeBakey model throughout fifty-five medical 'regions'.

From this starting point, two sets of consequences ensued.

1 The actual goals of the local regions turned out to be different from central's. The regions were 'discovered

systems' with their own interests and their own styles of interaction, regardless of the purposes central assigned to them. The regions were interested, for example, in supporting local medical schools, compensating for a decline in medical research funding, and securing continuing resources for programs already established. Key actors in the regions were concerned with their own survival in their positions, with independence of action, with local conditions and needs (as opposed to central's view of them), with the protection and extension of their territories, and with the maintenance of local stability.

Under these conditions, the familiar game began to be played in which what central saw as an opportunity for shaping local behavior, local agencies saw as a way of capturing central resources for their own ends.

2 This separation of the central manager's system and the discovered systems of the regions had its consequences for evaluation.

When the two systems have little overlap and little interaction, evaluation is limited to retrospective justification. In this condition, the evaluation system produces statements believed neither by producer nor by the consumer ('We have established a regionalized medical technology transfer system') which are generated ritualistically in response to formal demand. Central demands a verbal indication of regional conformity with central policy, and the discovered system of the region responds by 'conning'. The two systems operate substantially in parallel, implicitly agreed not to disturb or influence one another.

Where central presses the regions for more concrete instances of conformity to central policy, the discovered systems of the regions may respond by adapting to the prescribed measures of performance but otherwise carrying on as much as possible as before. Central can evaluate and control only through measures, but the measures are always distinguishable from the desired performance

itself. So RMPs provided information on 'numbers of nurses trained' or 'numbers of physicians subscribed in courses'.

In an analogous effort at evaluation and control, Congress once pressed the Vocational Rehabilitation system to indicate how many 'rehabilitations per year' the agency effected for a given investment. 'Rehabilitations' were defined as placings in jobs lasting three months or more. As a consequence, the Vocational Rehabilitation system began to 'cream' its clientele for those most likely to find jobs, leaving out those who were most in need and least able to qualify; it began to select low-level jobs for graduates so as to make it easier for them to get accepted; systematically to avoid distinguishing between a 'case' and a person, so that a graduate who had been given a job, lost it and returned to training, could be counted as another 'rehabilitation'; and systematically to avoid follow-up of clients after three months.

But the discovered systems of the regions were by no means entirely negative in their effects. Some coordinators were beginning to use the Regional Medical Program to help solve what they saw as the local problems of the medical care system of the region. They saw the medical care system mismatched to need and unable to respond because of manpower shortages, the attitudes of the professions, and the fragmentation of a system whose elements are not under the control of any single person or agency.

In some of the regions, coordinators devoted themselves primarily to the sorts of changes in institutional arrangements which, from the point of view of the DeBakey model, figured only as a means to an end. For them, RMP dealt with an overall improvement in the quality and accessibility of care. This required changes in the structure and interaction of the institutions concerned, so as to 'knit together components of the system'.

For example,

- In one State, the coordinator used the problem of purchasing and distributing new facilities for coronary care as an occasion for inducing thirteen community hospitals to undertake a broad-ranging process of joint purchasing and planning.

- In North Carolina, the coordinator used the program to connect the medically rich resources of Raleigh-Durham with the medically poor back counties of the State.

- In New Jersey, the coordinator managed to get several of the large, urban medical centers to take on responsibility for medical care in the urban ghettoes in which they lived, but which they had previously ignored.

In short, some of the coordinators began to use RMP as a vehicle for transforming the medical care systems of their regions.

In the meantime, certain changes were occurring at the national level. There had been a movement into good currency of certain basic concerns about the national system for providing medical care—concerns about rising medical costs, about the effective exclusion from the health care system of large numbers of disadvantaged people, about shortages of medical manpower, about the difficulties of negotiating the medical care system even for ordinary middle-class people. The effect of substantial investment in Medicare and Medicaid had begun to convince observers that no amount of investment in payment for care would suffice to introduce necessary changes in the system providing it. Clearly, there had to be intervention on the provider side as well. Yet there were overriding objections both to the development of nationalized systems of care and to the widespread use of decentralized solutions such as community-based group practice. Shortages of medical manpower suggested that efforts to

change the system would have to use existing personnel and, very largely, existing institutions. This meant trying to foster voluntary rearrangements of existing institutions. And of the available programs that might be used to bring this about, RMP seemed perhaps the most promising candidate.

RMP-central responded, then, not by punishing the 'deviant' coordinators but by beginning to reformulate central policy. 'Transformation of the system of medical care' began to become the central concept of the program. But from this, several things followed:

- There was no model for systems transformation which could be spread uniformly over the regions. Each region had its own starting conditions, and presented its own special problems.

- Each regional process had to be regarded as essentially open-ended. It could not impose a medical care system on the region. It had to be committed to engaging the emerging issues of medical care, whatever these turned out to be.

Central's role, therefore, had to shift. It could enunciate *themes* of policy—'transformation of the medical care system,' 'equity of access to care'—but it could not formulate and impose a program for adoption by the regions. On the contrary, the generation of central policy had to be *inductively* derived from the regions. Regions developed variations on central themes.

There could therefore be no central evaluation of regional performance. But central could provide 'meta' evaluation of the regions—that is, it could require that the regions generate their own developing policies for change, and that *they* devise and use systems of evaluation which would permit them to justify, control, and learn from what they were doing. Moreover, central could connect regions with one another to produce what

was, in effect, a network for learning about transformation of the medical care system.

Implementation of policy in a learning system

The problem of implementing policy in a learning context is the problem of setting in motion and guiding, around central policy themes, a network of related processes of local public learning.

Within this process, the formation of policy cannot be neatly separated from its implementation. Every alleged example of local implementation of central policy, if it results in significant social transformation, is in fact a process of local social discovery. After-the-fact, there may be a way to state the new social policy to which all the local discoveries conform. But before the fact, there is no single policy statement which can be used to induce them.

Hence, the fostering of these processes cannot take the form of pre-defining policy and causing it to fan out from a center. Central may provide first instances or policy themes which are take-off points for chains of transformation in localities. It may help local agencies to learn from one another's experience. It may even lend its weight to shifts in power structure which seem likely to lead to social discovery at the local level.

Also, the transformations of local systems influence one another, and may be supported in doing so. Moreover, the gradual transformation of the system as a whole influences the context in which each local system experiences its own transformation. The broad process can 'go critical' as ideas underlying the family of transformations come into good currency and as the numbers of learners and extenders multiply.

A system capable of behaving in this manner is a learning system. Within it, central's role is that of initiator, facilitator and goad to local learning. Such a process comes inevitably into conflict with demands for

stable adherence to specific policies, and with demands for uniformity in the application of policies. It comes inevitably into conflict with many traditional procedures of the legislative and administrative process. It places special demands on the social systems of the agencies and on the networks through which information, people and money flow from central to local agencies and from all of these to one another.

IV Government as a social system

We have so far concentrated on functions of government essential to public learning, processes by which issues and ideas emerge as powerful for action, processes by which policy comes to be implemented. But government is more than a series of functions. It is also a social system built around those functions, and its characteristics as a society determine its ability to engage in public learning.

It is a negative but by no means entirely inaccurate characterization of government agencies to say that they are memorials to old problems. From this point of view the Department of Agriculture is an organizational edifice constructed around the problems of agricultural productivity as they appeared in the United States in the latter part of the nineteenth century. The fundamental solution of these problems, to the point of creating new problems of agricultural surplus, did not lead to the passing away of the Department of Agriculture but to its expansion; there are still 70,000 agricultural extension agents operating in the field in the United States.

The Department of Labor came into being around the problems of unemployment and labor conflict as they arose in the 1930s. The solution of these problems, or the development of independent institutions dedicated to their solution, has not led to the disappearance of the Department of Labor but again to its extension. The Department of Commerce is an accretion of new organizational structures added to old ones; its growth process

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is organic and results in products like the stratified layers of shells. The Small Business Administration is a monument to Congressional nostalgia for the 'little man who made it', even though his entrepreneurial role in American industry no longer has the status or importance it once had.

The general rule is that agencies come into being and assume their form in response to specific national problems and crises. When the problems and crises disappear or change drastically in nature, the old organizational structure persists. The actual physical structure of Washington, with its layers of buildings in varying architectural styles, is a symbol of this organizational process. In government, as in most other established institutions, the organizational equivalent of biological death is missing.

Words such as 'inertia' or 'bureaucratic stagnation' or 'resistance to change' are not particularly helpful in explaining this process. As with other dynamically conservative societies, it is essential to understand the ways in which government agencies provide for their members a basis for security, not only a secure job but a necessary feeling of place and belonging. The agency provides a focus for loyalty, a definition of role, a sense of identity, an upward path through which progress and promotion are defined, and a perspective on the world. The concept of agency as a functionally autonomous society, responding to the most deeply felt needs of its members, helps to explain something of the vital persistence of agency structure and organization in the face of shifts in the character of the situation which brought that agency into being. Even the language used in the agencies helps to make this clear. I have always been struck by the number of different agencies in which 'the bureau' has only one meaning and 'the director' refers only to one man.

Units of organization differ, of course, in the extent to which they are deeply rooted in these social functions.

In the Department of Commerce, for example, the Bureau of Standards and the Bureau of the Census, the Coast and Geodetic Survey, and the Weather Bureau are particularly notable in this regard. Membership in these organizations carries with it connection to a tradition which provides both values for judging the outside world (for example, the critical importance of values attaching to measurement, precision, detachment, objectivity, scientific method and fairness) and a sense of the importance of one's own role. Personnel policies, like those defining tenure for civil servants, do not create organizational loyalty and organization persistence; they merely provide the legal and institutional counterpart of the social function.

Government agencies are societies that display special forms of dynamic conservatism. One need only reflect on the feelings of a member of an agency bureaucracy who has been in government sufficiently long to feel committed to it as a career and to see retirement benefits as his principal form of financial security. If he has lived in the agency for a period of ten years or more, he is likely to have seen at least five changes of chief. How do you respond when you are a member of an organization whose head keeps being chopped off? An entire array of strategies and life styles has grown up to permit survival at minimum cost and in some instances to protect determined persistence at productive work. The strategies include probing the character, intentions and sophistication of the new incumbent; currying favor in a new program; internal sales; re-casting in terms of new programs the activities to which one has long been committed; search for the tall grass in which to remain impervious to attention; ways of giving the boss what he wants with minimum disturbance of ongoing activity. There are in a number of government agencies individuals of high intelligence and great dedication, whose only means of persisting in work on problems they judge to be of

national importance is a kind of guerilla warfare through which this work is either bootlegged, hidden, or recast continually to meet the perceived requirements of new temporary chiefs.

In addition, the relationship of agencies to one another is best characterized as a conflict of rival baronies, each jealously guarding its own territory and seeking to expand that territory at the expense of other agencies. No new program moves into the Federal Government as into a neutral space but always into a field of force built out of the territorial fears and ambitions of the agencies. These persist from administration to administration, have a life-cycle that is longer than that of any given administration, and while influenced by the activities of an administration, lead a life of their own. As a result, it sometimes appears to an outside observer that the Federal Government contains many extremely intelligent, highly dedicated, experienced individuals who work long hours over long periods of time cancelling one another out.

Given these characteristics of the system of agency societies, what happens when a new national problem emerges? (That is to say, when an old national problem comes into good currency and presents itself, through processes which have been suggested in an earlier section, as a fit subject for federal action.)

Within the last two federal administrations, examples of such problems are the following:

- The decay of the city
- Pollution of land, sea and air
- Relations between universities and their surrounding communities
- Regional economic development
- The problems of industrial work generally grouped under the heading of 'automation'

- The handling of scientific and technical information
- The problems of assessing national requirements for manpower and of developing manpower adequate to those needs.[11]

When a problem of this kind is discovered and comes under consideration, it usually reveals a highly fragmented picture in which every major agency owns a piece of the problem. I remember a conversation between Luther Hodges and a number of his aides when Hodges was Secretary of Commerce. The conversation began with the problem of water resources. One of the aides said: 'We have been looking into the matter and it looks to us as though there are about twenty agencies involved in water resource development.' Another said: 'That's strange, we have been concerned with pollution control, and there are about twenty agencies involved in that.' Hodges offered the opinion that this was perhaps because, after all, there were about twenty major agencies.

The problem of the cities belongs in the Federal Housing Administration because of its special concern with urban housing. It belongs in the Department of Commerce because of the role of the cities in economic development. It belongs in the Department of Health, Education and Welfare because of the city as a focus for health, education and welfare services. It belongs in the Department of Agriculture because the city consumes the nation's agricultural products. It belongs in the Department of Interior because the city is a center for the consumption, distribution, and use of natural resources. Moreover, every major agency turns out to be undertaking programs which relate in some direct fashion, or which can be interpreted as relating, to urban problems. The same is true with respect to every major problem listed above.

As a new federal problem is identified, such fragmentation comes to light.[12] And there is apt to be at the same time the beginnings of in-fighting over territory. At this point, there are several alternative strategies available to an administration that wishes to launch a major attack on the problem:

1 Establish an inter-agency committee whose function is to coordinate and jointly manage the various agency activities relating to the problem area. Such a committee can be defined with a weak role, such as that of keeping track of or monitoring activities, or it can be given a strong role relating, for example, to the development of standards of agency performance, or even to the coordination of inter-agency activity. I have participated in about six inter-agency committees with durations of one year or more, and as a matter of interest have enquired of other individuals who have also participated in them, whether anyone has been a member of such a committee which was effective in carrying out the functions assigned it. I have never received an affirmative answer. The committee may make a show of performance during the early stages of its operation and particularly if it is subject to some strong external threat (as the inter-agency committee on scientific information was, for example, during the early sixties). But shortly, usually within a matter of months, the principal forces at work appear to be those of individual agency baronies and the demands of territoriality. The actual, as opposed to the official agenda, becomes that of assuring and protecting the territorial interests of each agency, rather than that of cooperatively attacking the problems which lie in inter-agency space. Given what has been said about the function of the agency as a society, the territorial relationships among agencies and the permanence of underlying bureaucracies compared to the transience of political administrations, this should be by no means surprising.

2 Another strategy is that of a consolidating reorganization. The establishment of the Department of Housing and Urban Development is such a case. So is the recent establishment within the Department of Health, Education and Welfare of the Social Rehabilitation Agency, bringing together independent groups such as Vocational Rehabilitation, Welfare, Children's Bureau and the like. In a smaller way, so was the establishment within the Department of Commerce in the early sixties of the Environmental Science Survey agency and the reorganization of the Bureau of Standards. The success of such reorganizations depends greatly on whether or not they are accompanied by a large infusion of new funds. If not, they are apt to consist of the simple coalition of operating units with a thin layer of coordinating administration and a new rhetoric of function, which usually exceeds by a great deal the actual ability of the agency to perform. The temptation is to continue to perform the old functions in the old way under new headings. An active administration will attempt to impose new activities and to revitalize old structures, and will find itself engaged in a complicated bargaining process with the heads of subunits.

3 Still another strategy is the creation of a new organization dedicated to work on the new problem. The Peace Corps and the Office of Economic Opportunity are both examples. The new organization can bring an infusion of new vitality, new faces and enthusiasm to new programs. The organization may be loose and informal and the morale and spirit high. Its problems will arise from the process of bureaucratic aging—a kind of life cycle. The problems of the aging process, for example, are what the Peace Corps, after about five years, seems now to be principally concerned with, despite the interesting invention of the 'five-year flush' as a way of preserving vitality. The current problems of the Tennessee Valley Authority are similar, though working over a

longer term. A characteristic pattern is that in which one administration will take a new problem and a new agency under its wing, provide it with special attention and a boss of character and energy, giving it unusual freedoms within the bureaucratic system and encouraging a climate of high morale and creativity. Over time, the specially protected character of the agency will fade away, bureaucratic restrictions will arise once again and encroach upon its territory, internal divisions will tend to rigidify, the original entrepreneur of the agency will leave, and a new chief of lesser originality and with fewer degrees of freedom in which to operate will take over.

This is, to some extent, a pattern characteristic of the creation of every new agency within the Federal Government. What one would like to achieve is very much like what every large-scale organization within our society would also like to achieve: a way of adapting flexibly to the emergence of new problems, discarding old structures as they become inappropriate and vestigial, and changing the character of approach, use of personnel and allocation of resources to suit new tasks as they arise.

Approaches to this sort of adaptation can be analyzed under the heading of 'self-renewing organizations' (where the shift to work on new problems can be accomplished within the boundaries of an existing organization) or under the heading of new forms of inter-agency organization.

A great deal has been written about the problems of designing self-renewing organizations.[13] Real accomplishment along these lines appears still to be marginal. Nevertheless, a number of relevant points can be made, some broadly applicable to all established organizations, some peculiar to the Federal Government.

- A great deal of the problem of organizational renewal has to do with the opening up of boundaries —both those of compartments within agencies and

those separating agencies from the outside world. The oldest and most static Federal agencies are those with the most air-tight organizational compartments—originally related to function but often, in the course of time, of unclear or irrelevant function. Horizontal movement across compartments becomes unthinkable. Similarly, static agencies are relatively isolated from the outside world—from other agencies of government, from broader communities.

The opening up of boundaries—through the breaking down or restructuring of internal barriers, enforced movement across barriers, and the infusion of new blood—tends to threaten not only established patterns of organization but also established ways of seeing the world and established ideologies tied to organizational form. This is true particularly of parochial views of the world (concern *only* with the department and its business) and of ideologies based on fear of 'the others' (the department as a bastion against the outside world).

- 'Young Turks' occupy a critical position. An agency head can revitalize his organization by attracting new bright young people, placing them in positions of unusual access to policy and program guidance (for example, by creating special 'assistant' and 'aide' positions), by designing training programs that expose young people to views from the top and confront departmental heads with their challenges. Informal organizations of young people—across divisional or hierarchical boundaries—can strengthen their role. One agency head has recently constructed an agency of young people, counterpart to his own, to develop counterpart agency programs and policies and to formulate and test out pilot projects.

- Characteristically, there develop among federal agencies informal networks that can realistically be called 'undergrounds'. These are groups of individuals attracted to the idea of change in agency policy and practice, and committed to the use of the informal system to effect that change. Such undergrounds may be used—as indicated earlier—to preserve continuity of effort underneath a changing pattern of agency heads. They may also represent guerilla movements aimed at changing agency policy and, sometimes, at subverting official policy to other ends.

  Occasionally, agency heads ally themselves with the underground, in order to force change through layers of official bureaucracy or to by-pass their own official structures.

  Again, informal connections may be established across agency lines, sometimes through individuals who serve as the nodes of these informal systems. Coalitions form around efforts to change particular policies, or movements are started to take advantage of crises to introduce change.

  Because most formal interagency measures fail, informal networks are often the chief means by which agencies can be coordinated in working on new problems that cut across their boundaries.

- New views of national problems, and of the role of the federal government, tend to form around individual leaders, and to be identified with them. But these leaders come and go. Their 'time constant' is usually shorter than that of the agencies in which they function, and shorter than the period needed to follow through the programs they have helped to define. Hence, one always has to consider how credible the leaders are to the more permanent middle levels of bureaucracy who will

finally take responsibility for the critically important implementation of programs.[14]

Further, the introduction of new program ideas tends to be accompanied, in a new administration, by sharp and frequently shifting political pressures for performance *now*. The effect is often to paralyze or demoralize the middle levels of the agency, who come to feel that they are unable to build anything.

The credibility of leaders has a great deal to do with their ability to protect those below from shifting and destructive pressures for immediate (and often contradictory) response. This protection may come from the interest of the President, who gives the program special treatment (as FDR did for the TVA and Kennedy did for the Peace Corps) or from the political strength and skill of the agency head himself.

◆ All of these measures and approaches represent ways of loosening up an agency so that it can address itself creatively to new problems. But the renewal may be a one-shot effort, lasting no longer than the tenure of a particular leader or of a particular administration. These measures do not of themselves ensure that the agency will continue to be capable of renewing itself, and attempts are sometimes made to build that capability into the structure of the institution.

From one point of view, the Planning, Programming and Budgeting System (PPBS), fostered by the Bureau of the Budget and based on techniques introduced by Secretary McNamara into the Department of Defense, is an attempt to institutionalize the capability for continuing renewal. It seeks to force agencies to define programs in functional terms, which permit alternative designs for accomplishing those functions; to develop ways of asses-

sing the outcome which systematically confront the agency's intent with its actual accomplishment; and to budget by function. But it has become clear that PPBS by itself cannot serve this end. The technique may force reconsideration of agency policies and may provide opportunities for those interested in change to move towards new definitions of programs. Equally, the PPBS may simply repackage old programs, without making a real change in function or organization.

Attempts to institutionalize the informal systems of agencies seem to embody a contradiction: the very vitality of informal systems depends on their informal status, their invisibility.

Opening up the boundaries of organizations, fostering the influx of young people, are measures with finite lives. They are not self-sustaining.

The tendency is for agencies to seek new stable states, coalescing around the modified programs, organizational structures, views of the world and ideologies that have resulted from the last infusion of innovation.

When the new problem does not lie easily within the boundaries of an established agency, flexible adaptation demands a response different from the self-defeating or time-limited responses listed earlier. If the question is how to produce not a one-shot response but a continuing adaptation, then one useful and evocative image is that of a structure made up of pools of competence and task forces. The characteristics of such an organization are these:

- Pools of competence are organized around disciplines or skills. These may be in the nature of 'content' skills—statistics, computer programming, accounting, economics, social service, engineering—

or 'process skills' such as planning, program management, coordination. These skills must be relevant to the demands of federal program and policy, and available when government requires them.

The managers of these pools are in a sense gardeners who are concerned with making good use of people, training and retraining them, keeping continuity of professional development, putting the right man in the right job, forming task-groups and returning the men in them into competence pools, and (most important) providing a basis for professional security throughout a period of changing tasks.

Ideally the objective of such an organization would be to develop a sense of identity and loyalty to it and to the objectives of the Federal Government, rather than to specific agencies or bureaus.[15]

- On the other hand, there would be a series of task groups responsible for specific projects. These would have shorter life cycles than competence pools. Members of competence pools would move in and out of task groups, in the manner of project management systems in individual firms. Projects would be managed so as to achieve their goals according to given criteria of performance and cost.

- Such a system requires an intelligence function which identifies requirements for new projects and determines the effect of ongoing activity; and a control function which monitors projects, presses for modification and determines the life-cycles of the projects. Both are part of a system of program management which organizes projects into coherent, connected wholes.

Clearly, such an approach is inappropriate to manage-

ment of the routine functions of government, to the relatively standard performance of tasks with long life-cycles like those performed by the Bureau of the Census, the Post Office, the Bureau of Labor Statistics, and the like. Even these functions have life-cycles, however—as indicated by the current crisis in postal operations.

Such an approach *is* appropriate to the management of new functions of government which are non-routine and have relatively short (though not precisely predictable) life cycles. In this respect, the model of a Federal 'project system' represents in the area of program management what has already become familiar and frequently effective in the realm of deliberation, evaluation and planning. The use of Federal task forces, commissions and planning groups, has become a commonplace. Task forces have been formed on problems of the cities, on crime, on children, on the problem of privacy. At any given time, their number probably is in the hundreds. They have limited lives. They are called into being by the President or by heads of offices and agencies. Their members are drawn from other organizations, Federal or non-Federal, and return to those organizations when their tasks are completed. The 'project system' model would carry over to program management an approach now broadly applied to the analysis of problems and the evaluation of programs.

The creation of new agencies like the Office of Economic Opportunity or the Peace Corps does not fit the model. Its failure to do so hinges principally on the issue of security.

People are attracted to new agencies both from old agencies and from business organizations and universities, as well as from local government, labor and the social services. Upon the disbanding of an agency (an event frequently discussed, but almost never undertaken) people could find their way into other agencies of government or filter back into the non-governmental sector. But

there are no provisions for such a transition. If no organizational home is in prospect, disbanding comes to seem threatening and disruptive. The prevailing expectation is that the agency will survive. In order to bolster the expectation, members of a new agency quickly learn the bureaucratic survival game, which requires identifying, linking to and serving constituencies powerful enough to insure the permanence of the agency. Examples are the Department of Agriculture's constituencies among extension agents and the extension departments of Land Grant Colleges, and the Department of Labor's constituencies within organized labor.

A federal project system would need to foster security through other means, by creating continuing pools of competence to which its members *expect* to return when their tasks are completed. There is a recent model in the 'in-and-outer' who moves from the university or foundation to government, and back again with a change in political fortunes, with the completion of a job, or simply with fatigue. This is again an informal network and one that works, by and large, only for an elite. No comparable arrangements exist for the lower and middle level employees and it is they who are left to carry on.

In spite of some relevant industrial examples, the form and location of competence pools and the techniques of management appropriate to them remain to be invented. The model, however, suggests a direction in which to seek the organizational flexibility required by the changing character of national problems.

Conclusion

Government is an institution for performing public functions and an agent for inquiring into public problems affecting society as a whole.

As an instrument of public learning, the federal government of the United States rests largely on a theory

of the stable state. It accepts as mysteriously given the issues around which policy and program must be shaped. It treats government as center, the rest of society as periphery. Central has responsibility for the formation of new policy and for its imposition on localities at the periphery. Central attempts to 'train' agencies at the periphery. In spite of the language of experimentation, government-initiated learning tends to be confined to efforts to induce localities to behave in conformity with central policy. Localities learn to beat the system. Government tends to bury failure or to learn from it only in the sense of veering away from it. Evaluation, then, tends to be limited to the role of establishing and monitoring the extent of peripheral conformity with central policy.

The social systems of the agencies mirror the theory underlying the implementation of policies. Agencies are the social embodiment of policies, and in their efforts to sustain and protect themselves they also sustain and protect established policy. New problems fragment established agencies just as they fragment established policies. With the loss of the stable state, policies must be viewed as transient, their change being the foreground condition, and continuing fragmentation of agencies and policies becoming the rule.

For government to become a learning system, both the social system of agencies and the theory of policy implementation must change. Government cannot play the role of 'experimenter for the nation', seeking first to identify the correct solution, then to train society at large in its adaptation. The opportunity for learning is primarily in discovered systems at the periphery, not in the nexus of official policies at the center. Central's role is to detect significant shifts at the periphery, to pay explicit attention to the emergence of ideas in good currency, and to derive themes of policy by induction. The movement of learning is as much from periphery to periphery, or from periphery to center, as from center to periphery.

Central comes to function as facilitator of society's learning, rather than as society's trainer.

Such a role is not appropriate to the stable areas of society in which steady, routine functions of government continue to be carried out; but it is appropriate to the areas in which public learning is required. Such a role deprives central of its monopoly on the formation of new policy. It demands a shift in the social system of government, which now serves and reinforces stable, compartmentalized policy. The concept of a government 'project system', made up of task forces and competence pools, serves only to illustrate what government as a self-transforming system might become.

When applied to government, this view of learning raises serious problems:

- The concept of legislation as a basis for policy tends to be accompanied by commitment to policy which remains stable over long periods of time. This view of public learning threatens established patterns of legislation, as well as processes for generating legislation and for relationships between administrative and legislative agencies.

- Arguments for the uniform application of policy (a phrase easier to state than to define) often rest on concepts of equity. What is the likelihood that the network of systems transformations at the periphery will result in policies which are equitable from region to region?

- Central government has as one of its functions the correction of inequities practiced in the regions—a function dependent, ostensibly, on its greater leverage and on its distance from the interests of established power in the regions. How is this function compatible with central's facilitative role?

These issues are real and they go to the roots of our

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governmental system. There may, indeed, be a conflict between the demands of public learning and the demands of legislative stability and governmental equity. If so, it is a conflict we must meet head on.

CONGRESS AND THE FUTURE

(By Clement Bezold)

Clement Bezold, the author, has done research on futurism in the legislative process and has now extended his studies to include state anticipatory democracy projects, such as Hawaii 2000 and Alternatives for Washington. His published reports include Strategic Policy Assessment: Activities and Prospects, which was prepared for the Commission on Critical Choices for America.

As the United States prepares to enter its third century, there is mounting evidence that its governmental institutions are unable to cope with the complex issues of today's rapidly changing, increasingly interdependent world. To avoid the pitfalls of crisis decision-making, an expert on the legislative process maintains, the U.S. Congress must provide itself with the capacity to do futures analysis of both present and potential laws and trends.

Crisis after crisis has befallen the government and society in recent years. The failure to anticipate problems, resulting in government by crisis, has led to serious-questioning of our normal decision-making procedures. Duting the summer of 1973 three futurists, Victor Ferkiss, Willis Harman, and Charles Williams, testified before a select committee of the House of Representatives, suggesting changes in the committee system to aid the House in becoming future-oriented. Their testimony possibly represented the first time futurists as futurists had testified to Congress.

How did the 93rd Congress act to overcome crisis decision-making? What must Congress do to better confront the future?

The first prerequisite of more foresight in government is better futures analysis. While the techniques are many and varied (Delphi and cross-impact analysis, simulation, econometric projection, etc), futures analysis fulfills two basic functions for policy making. First, more systematic futures analysis provides an "early warning" function. In a rapidly changing advanced industrial society, problems often escape notice until they reach crisis proportions. This "early warning" activity would search out emerging problems and define the strategic decisions or actions which have a major or fundamental impact. Better futures analysis also would provide decision-makers with information on the relevant trends, conditions, and interrelationships projected 5 to 25 years into the future. In this regard the House of Representatives gave its committees an important "foresight" responsibility to monitor trends, conditions and events, both to search out emerging problems and allow for better informed current decisions. Other additions to internal congressional operations include increasing the futures analysis activity of the existing central support organizations (the Congressional Research Service and the General Accounting Office) and the establishment of two more support organizations, the Office of Technology Assessment and the Congressional Budget Office.

Congress has also been active in encouraging better futures analysis in the executive branch within several broad policy areas, including science policy and social policy.

Analysis not coupled with the power to act is often useless; it is a necessary but not sufficient condition for responsible future-oriented decision-making. The other prerequisite is the forcing of decisions—providing mechanisms which require the conscious consideration of interrelated decisions. Futures analysis as early as the 1950s suggested the emergence of the energy crisis. Yet no agency or congressional committee had the responsibility to monitor developments and interrelate the various decisions affecting energy. The U.S. developed an energy policy by default; the interrelated decisions were not consciously confronted and even now, after the arrival of this crisis, there is no mechanism yet established with responsibility to force energy policy decisions. While there was some action to overcome this, the major overall decision-forcing mechanisms considered by the 93rd Congress dealt with the congressional budget and national growth policy.

The President's budget has long been recognized as the major decision-forcing mechanism for overall policy in the executive branch. The interrelated effects

of taxing and spending action are consciously confronted and spending priorities established. The single executive budget was established in 1921 but Congress never confronted all of its spending measures at one time. In 1974 Congress gave itself this decision-forcing procedure and the potential for better future analysis through its own congressional budget reform. Congress also considered but did not act on mechanisms to force interrelated decisions beyond the budget in the form of national growth policy.

FORESIGHT PROVISIONS ENCOURAGES FUTURES ANALYSIS

One of the best examples both of congressional reform and the role of futurists therein is the work of the House Select Committee on Committees. Generally called by the name of its chairman, Representative Richard Bolling, a Missouri democrat, the Bolling Committee was estalished in 1973, at the beginning of the 93d Congress, to recommend changes in the House committee system.

The Bolling Committee made a thorough and comprehensive examination of congressional operations and considered the problems of better confronting the future from several perspectives. One of these was to reorganize the jurisdictions of the House committees. The committees of Congress provide the specialization necessary to conduct congressional business; yet they also tend to fragment policy making, particularly in their current policy divisions, established in 1946. As committee member John C. Culver of Iowa (now a Democratic senator) put it: "The past 25 years have seen a revolution in areas of public policy and concern and have added dimensions to Congressional responsibilities which were not—and, in many instances, could not—be foreseen in 1946."

The committee considered several reorganization plans but settled on one which included some major shifts of policy jurisdictions, notably putting energy and environmental concerns into one committee, and transportation in another. Yet these jurisdictional changes threatened the power of those who had seniority and chairmanships under the present system. Also business and some consumer lobbyists, including Ralph Nader and certain environmentalists, opposed the plans because they felt it would hurt their position or established relationships with present committee members and staffs. Ultimately the proposed jurisdiction changes were severely watered-down by amendments.

The Bolling Committee also considered the need for a central committee in the House to set goals in a comprehensive framework and to force decisions—a goals and growth policy committee or a budget committee. The Bolling Committee excluded budget reform from its proposal because that was going on elsewhere in the Congress and also avoided any other options which would force decisions affecting policies across committee jurisdictions.

However, the Bolling Committee did take a major step toward requiring the committees to provide their own "early warning function" and better future analysis for current decisions. They proposed a foresight responsibility for each substantive committee. This was the result of efforts by Culver, who realized that rather than isolate futurism in a central committee, "it should be instilled as a responsibility within any committee jurisdictional inquiry." Otherwise, in the congressional context it would reduce "itself all too easily into esoteric irrelevance."

What was decided was to require each committee to perform futures research and forecasting in its policy area. The purpose would be to assess trends and conditions in the policy jurisdictions of the committee to determine the need for new legislation and to provide better information in dealing with established laws. The foresight provision was added to the oversight section of the Bolling Committee's proposal and passed by the House in October of 1974.

Futurists Testify Before Congress

Since the Bolling Committee hearings were one of the first times that futurists as futurists testified to Congress, it is worthwhile to note their testimony in relation to other expert testimony for the Bolling Committee. The testifying futurists were asked to comment on significant trends or conditions and their relevance to the organization of committees or congressional operations. Their recommendations for the committee system included more flexibility, in terms of ad hoc committees, and more horizontal organizations in the form of committees which cut across subject area divisions. (The substance of the futurists' testimony is summarized in the October, 1973, issue of The Futurist.)

The reaction on the part of committee members and observers was mixed. Culver was enthusiastic that the Bolling Committee had asked the futurists for their advice on relevant trends and on how Congress might better confront

the future. Yet he stressed the need for some mechanism to instill this concern for the future into each House committee. Representative Paul Sarbanes (a Maryland Democrat) noted the lack of predictions of political activity in the futurists' testimony, especially in relation to their social and economic predictions. He tried three times without success to get the futurists to "relate these trends to the kinds of pressures or strains that may appear in our political life." A staff member very familiar with congressional operations regretted the absence of political trends and found the discussion during the futurist panel dull in relation to other panels held by the Bolling Committee. Thus those who came to the panel with an interest in futurist activity found the panel interesting. Others, particularly those seeking specific comments regarding congressional activities, were not as satisfied.

It is interesting to note that testimony similar to that of the futurists, yet with more detail about congressional operations, was given by Representative John W. Davis (now out of office), the chairman of the Subcommittee on Science, Research and Development of the House Committee on Science and Astronautics (now Science and Technology). Davis, a Democrat from Georgia, noted that "a responsive Congress—any responsive organization—must approach the future as an environmental unknown that needs systematic evaluation . . . With a systematic assessment of possible future developments, legislation might perhaps be more 'preventive' than 'curative'." Davis suggested this "early warning function" could be provided by the Congressional Research Service (CRS), the Office of Technology Assessment (OTA), the committee structure itself, or elsewhere.

The Bolling Committee proposed building the function into the committees themselves through the foresight responsibility. The expert testimony most relevant to this was given by Walter Hahn, then the acting director of the Division of Science Policy Research of the CRS. Testifying as part of the panel on committee information sources, Hahn recommended the use of futures research and technology forecasting by the committees. The Bolling Committee ultimately proposed that each committee perform futures research and forecasting.

The futurist reforms suggested by the Bolling Committee indicate the importance for reform efforts of knowing both the specific decision-making system—in this case congressional committees—as well as the larger environment. Knowing the decision-making system involves a familiarity with the operating procedures and political relationships which structure that system's rationality. This knowledge of the "political rationality" of Congress is important in understanding the implementation of the foresight provision.

Few Committees Implement Foresight Provision

Although the foresight provision has been enacted, a question remains as to what effect it will have. A preliminary survey of committee staff directors in December of 1974 suggested that there was little familiarity with the provision and some opposition to it. The staff director of one important committee doubted that much would be done to implement the provision, stating: "Long-range planning is not congenial to the legislative (political) environment. Oversight activities tend to gravitate toward what is politically interesting in the current session. There are enough pressing problems of the moment to pre-empt limited staff resources."

While this is a frequent reaction to futurist activity—pressing problems preclude long-range and more systematic consideration—the first few months of the 94th Congress offer some encouragement. Foresight subcommittees have been established by a few committees and topics that should be considered in foresight hearings are being prepared. Also a great demand for the results of futures research and forecasting could come from the 91 new members of the House. Those freshmen congressmen who are interested in aggressively pursuing good policy may begin to search for issues which are both important and not yet covered by other members. The operation of the foresight provision could identify the most important emerging issues within a committee's jurisdiction and facilitate the channeling of the new members' interest and energies into them.

In addition there is some interest in the Senate in adopting the activities called for in the foresight provision.

The passage of the foresight responsibility for the House Committees suggests several tenative conclusions about this type of congressional reform. First, reform is likely to come in small steps—in the congressional decision-making system it is easier to do analysis than to force decisions, particularly if forcing decisions will involve a redistribution of power. Second, futurist input must be structured

in terms of the experience and attitudes of the members of Congress and the operations of the relevant committees, the Congressional Research Service, etc. Third, passage of a reform does not insure its effective implementation. And finally, awareness must be developed on the part of the general public as well as interest groups of the need for more foresighted operations, and public support for these foresighted operations must be shown.

Futurism in Congressional Support Organizations

In addition to committee and personal staff, members of Congress are aided by four centralized support organizations which provide various types of analysis.

The Congressional Research Service (CRS) has been the most active in this area, since the 1970 Legislation Reorganization Act gave it a mandate to increase its policy analysis and to develop an anticipatory capacity for committees. CRS was called on to "prepare and present to each committee at the beginning of each Congress a list of subjects and policy areas the committee might profitably pursue." To do this CRS established interdisciplinary teams, corresponding to the jurisdictions of the various committees. The CRS teams prepared preliminary lists, then negotiated with the committees regarding how broad a list the committee actually wanted to receive. This can be considered as a rough gauge of the interest in the committees to search out new issues (or use CRS expertise to do so). During the 93rd Congress, the committee response was varied. The appropriations committees took no lists at all. The taxing committees also made little use of the service. On the other hand, the House Space and Astronautics Committees and the Senate Committee on Interior and Insular Affairs had an extensive list prepared and actually began consideration of many of the issues raised.

Within the CRS the Science Policy Research Division has been the most concerned with futurist type issues. As mentioned above, Walter Hahn, as the acting director of that division, was the person in the Bolling Committee hearings who recommended that the committees use future research and forecasting as part of their policy analysis and their search for problems.

As an outgrowth of this concern and in anticipation of the foresight provision in the Bolling Committee reforms, CRS established a "futures group" headed by Dennis Little, whose task is to educate CRS and committee personnel and members of Congress in futures research and forecasting techniques and applications. Another test of congressional interest in futures activity over the next few years is the demand for the services of this futures group.

The General Accounting Office (GAO) is concerned with the evaluation of programs initially in terms of accounting and efficiency and program effectiveness. More recently GAO had moved into the area of assessing the value of programs before they are adopted or implemented, including the SST and certain weapons programs. This type of futures analysis involves estimating whether the program or technology would meet the need, and the likely future status of the need itself.

The Office of Technology Assessment (OTA) has several functions relevant to the more conscious concern for the future. Technology assessment is primarily concerned with determining the second- and third-order consequences of the use or potential use of technology. OTA does this for committees considering an issue, such as oceans policy, solar energy or bioequivalence of drugs. OTA also has an early warning function and therefore devotes some energy to considering what problems are likely to arise in the short- and long-term future. To determine some consensus on emerging problems and their relative importance, OTA has used surveys of experts who suggest high priority candidates for assessment. During the 93rd session OTA had just begun to operate, so the impact it will have on congressional decision-making is uncertain. Yet it could provide significant futures analysis both on the impact of current decisions and on emerging problems.

The Congressional Budget Office (CBO) was created by law during the 93rd Congress but did not begin to function until the 94th. Its significance will come from its direct connection with the congressional budget, the mechanism which may become the major decision-forcing mechanism in Congress.

Futures Analysis in Issue Areas

In addition to acting on their internal procedures Congress was moved to introduce more futures analysis through specific types of policy, particularly science policy and to a lesser extent social policy.

A recent issue of The Futurist pointed out, "the future often begins with science, because discoveries make new technologies possible." As this statement suggests, technology and science are so closely linked that this area includes them both.

Much support for this area as a source of better futures analysis comes from the basic science industry and the space industry. More specifically, a large part of the interest in futures research and forecasting, and the professionals trained in this area, are a result of the space industry and its need for accurate technological forecasting.

During the 93rd Congress there was much concern, particularly in the Senate, about the role of science policy in the White House. Since the beginning of the space race, presidents have at times relied heavily on their science advisors, particularly regarding funding for research and development.

Senator Frank Moss, a Utah Democrat, commented that the U.S. was often "crisis driven," and said, "Hindsight in nearly every case has revealed that warning existed but went unheeded. There was no formal mechanism at the national level by which the country could anticipate these problems and orient our research and development resources toward coping with the coming storms."

The Office of Science Advisor in the White House partially fulfilled this function from 1962 to 1973. Persident Nixon changed the name to the Office of Science and Technology in 1970. In 1973 he abolished the Office and passed most of its functions to the National Science Foundation. This has prompted efforts in the Senate to formally reinstate science "down the hall (in the White House) not down the Mall (in the National Science Foundation)." Democratic Senators Edward Kennedy (Massachusetts), Frank Moss (Utah), Warren Magnuson (Washington), and John Tunney (California) joined efforts in promoting both the reestablishment of an Office of Science and Technology in the White House and encouraging the use of technological solutions developed in the space industry for solving other domestic problems. The resulting compromise bill, The National Science Policy and Priorities Act, passed the Senate in October of 1974 and has been reintroduced in the 94th Congress.

In the House, the Science and Astronautics Committee (now the Science and Technology Committee) has been the most concerned with performing systematic futures analysis, because of its responsibility for research and development policy. It was the activity of Representative Emilio Daddario, a Connecticut Democrat, as a member of this committee which resulted in the establishment of the Office of Technology Assessment in Congress.

One of the major indictors of the success of futures analysis is in the mind of the decision-maker; how well informed and rich in detail is the Congressman's image of the future and its implications for his current decision. In the Bolling Committee hearings the testimony of Davis, as mentioned above, showed the greatest concern for future trends as they relate to committee operations. His approach and the richness of his image of the future and its relation to congressional decision-making probably result from his work as Chairman of the Science, Research, and Development Subcommittee of the former Sciences and Astronautics Committee. He was a chief sponsor of the bill establishing OTA.

An indicator of committee interest in futures analysis is their use of the lists of emerging issues or "subject lists" developed at the beginning of each session by the CRS. In this regard the House Science and Astronautics Committee asked for, received, and began working on the largest number of emerging issues of any committee in either the House or Senate.

Social Policy Forecasting Lacks Support

The concerns of science and technology have generated futurist analysis methods, professionls to apply the methods, and some commitment to them, but in the area of social policy, forecasting and futures research is not as developed nor does it have as much support. While not predominantly future-oriented in its concern, one approach which would provide better overall futures information for social policy is that of Minnesota Democratic Senator Walter Mondale's proposed Council of Social Advisors. In each of the past three Congresses the Senate Labor and Public Welfare Committee has passed the proposal; the Senate passed it in the 91st and 92nd Congresses. Patterned after the bill which established the Council of Economic Advisors, the proposal would give the White House an entity comparable to the evaluation, planning and development offices of the departments and agencies. This Council of Social Advisors would look "at the great strategic questions that transcend the boundaries of the individual departments."

This bill can be seen as part of, and a stimulus to, the social indicators movement. Social indicators basically involve the quantitative description or measures of social conditions and trends which are proposed or constructed to inform the

public or decision-makers. The absence of good quantitative measures of social phenomena and hence social change is one reason why futures analysis is less advanced in the social policy area than in the science policy area.

Budget Reform Helps Congress Establish Priorities

One of the central problems in better confronting the future is the lack of any central mechanism which forces decisions to be made in relation to each other and in the context of the likely future effects of decisions. The President's budget has long been recognized as the major instrument he has for shaping his policy. All program decisions are related to each other in the relative terms of dollar expenditures. While these relative monetary comparisons often do not reflect relative need because of differences in cost, they are at present the only major expression of our "national priorities."

Prior to 1921 each executive agency came directly to Congress, and within Congress each request was considered individually. The resulting chaos in the appropriations process led Congress to give the President the power to request funds for the entire executive branch and the responsibility to formulate the independent requests into a coherent package. Congress tried without success to consider all requests in one package, to formulate a legislative budget, in the late 1940s. Yet if Congress is to be an institution coequal with the President, it must be able to express its own priorities by relating all revenue and spending decisions in one place.

Spurred by the threat to its constitutional power of the purse from the Nixon impoundments, the 93rd Congress established for itself this overall budget capability. The ultimate reform, the Budget Act of 1974, was aimed at providing Congress with the mechanisms for expressing relative priorities and the technical budgetary information and policy analysis necessary to consider the trade-off decisions involved in different budget alternatives. Providing this information and analysis is the primary role of the Congressional Budget Office (CBO).

A major futures function in the budget reform is the analysis involved in the report the CBO will prepare annually which examines the President's budget proposal and various alternative sets of priorities. Five-year taxing and spending forecasts will be made which, according to one member of the House Budget Committee, will involve futures research in addition to simple revenue and expenditure projections.

Two other futures-relevant aspects of the CBO's annual report stem from legislative proposals built into the final compromise bill. Senator Lawton Chiles, a Florida Democrat, had a separate budget proposal bill which would have restructured the budget categories to better reflect the national needs the expenditures are meant to satisfy. The CBO's report must include consideration of this. At the insistence of Senator Hubert Humphrey, a Minnesota Democrat, the CBO report will also include an analysis of how the various budget alternatives would affect national growth policy. Since the mechanisms to define national needs and to formulate national growth policy are not yet established, it will be up to the CBO to determine to what extent its report analyzes these topics.

Whether or not the budget reform will work is still an open question. The budget process will tend to raise the level of conflict, by making budget trade-offs visible, and will shift some power from the taxing and spending committees. While this would be difficult to accomplish at any time, it is even more difficult in the current period of economic hardship. Members with power over certain programs are reluctant enough to make budget cuts themselves, and cannot be expected to want to give someone else the power to make cuts. In addition to these problems within each chamber, there will also be conflicts between the House and Senate. For example, there was a disagreement over who should head the CBO; the Senate wan ed someone with an independent reputation capable of imaginative analysis, while the House wanted someone favorable to the more fiscally conservative positions of the House. This delayed the establishment of the CBO until February, 1975, when the Senate finally won and Alice Rivlin of the Brookings Institution was named the director of the CBO.

To what extent the CBO in its analysis, and the Budget Committees in their decisions, use a longer time horizon will depend largely on Alice Rivlin and on the Chairmen of the House and Senate Budget Committees, Representative Brock Adams (a Washington Democrat) and Senator Edmund Muskie (a Maine Democrat).

Growth Policy Formulation Forces Decisions

In Congress there is often great disagreement over the goals of government policy. The deadlock that this might cause is avoided by debates over means, i.e., specific programs. Thus disagreement over ends is replaced by agreement over means. This allows members to support the same bill but for different reasons. The budget is the place where the trade-offs between the means (specific programs) are made in terms of specific dollar amounts.

Determining which decisions are strategic or fundamental requires a reference to larger ends. Thus the fight over means makes this more difficult. While the debate over the means makes sense to the extent that we often do not know precisely how programs meet a variety of needs, there are ways that larger ends can be put into a more coherent context. Also the use of the budget to force trade-off decisions on different policy expenditures does not assure that the horizontal linkages between policies will be considered. The relative costs of housing and transportation programs, for example, will be considered, but their long term policy interrelationship probably will not. The formulation of national growth policy seems to be the best way to consider larger ends, the futures aspects of current decisions, and their horizontal linkages. In effect, it is the best place to join futures research and forecasting with important decisions. Also it might aid decision-makers in avoiding the tendency to deal with problems incrementally because of the logic and politics of the budgetary process.

As one group of experts put it, growth policy should attempt to provide mechanisms and procedures that would "enable the nation to more clearly anticipate the consequences of public and private actions on the quality and structure of life in the national community than has been possible in the past."

While there are disputes over the definition of growth policy, for our purposes it will consist of four elements: social, economic, and environmental policies, and development policy, which is concerned with the distributional aspects of the other three. Growth policy will also include procedures and organizations which articulate the larger ends involved and harmonize the activities of the various specialized agencies within the social, economic, environmental, and developmental areas in accordance with these larger ends.

During the 93rd Congress there was activity on four fronts regarding growth policy. Three had to do primarily with analysis, the fourth with specific mechanisms to force decisions, as well as provide the necessary analysis.

The activity regarding national growth policy reflects a divergence of attitudes between the Republican President and the Democratic Congress over the importance of growth policy. In title VII of the Housing and Urban Development Act, passed in 1970, Congress required the President to issue periodic reports on national growth. The Administration reluctantly issued its first report in 1972. Representative Thomas Ashley, an Ohio Democrat who was the principal author of Title VII, held hearings that were basically critical of the President's report. Ashley's subcommittee noted that it implicitly denied the need for forceful federal leadership and called for continued congressional leadership in the activities necessary for determining national growth policy:

1) defining specific development goals for the country,
2) recommending programs and techniques needed to achieve these goals,
3) constructing the decision-making and implementing mechanisms needed to define and carry out the nation's growth policy on a continuing basis.

Subcommittee Examines Implications of Growth

Another approach to the analysis of growth questions has come from the Subcommittee on Fisheries, Wildlife Conservation and the Environment, chaired by Representative John Dingell, a Michigan Democrat. Based on his oversight of the implementation of the National Environmental Policy Act of 1970, Dingell concluded that the "Federal Government had only begun to conduct full and adequate environmental assessments of growth-oriented programs and policies." To encourage a continuing and open dialogue in the Congress, Dingell began hearings on "Growth and Its Implications for the Future." The hearings included portions of the work of Dennis Meadows, co-author of *The Limits to Growth*, and several other authorities, as well as the results of a two-year graduate seminar at the Massachusetts Institute of Technology on strategies for sustainable growth. One of the results of these hearings is a proposal by Dingell for a National Environmental Policy Institute which would do "strategic policy analysis."

A third approach to analysis for growth policy was provided by the House Public Works Committee. Committee chairman John Blatnik, a Minnesota Democrat, felt the need for more specialized and technical advice than was currently available and formed a Science Advisory Panel to prepare preliminary reports for the committee's inquiry into the desirability and feasibility of a national public works investment policy—an important part of growth policy. The reports thus far raise questions regarding the growth and distribution of the population, as well as the national and regional entities which operate in this area.

Currently there are no mechanisms or procedures to consciously set national growth policy. In effect our future in this area is being defined by the unconsidered decisions taken in various places in private industry, in the government and by consumers. The fourth major approach to growth policy, which would make these decisions visible and establish mechanisms to deal with them, is Senator Hubert Humphrey's proposal for balanced growth and development policy.

Bill Would Set National Growth Policy

When Senator Humphrey introduced the Balanced Growth and Development Act of 1974 he stated:

"Only through an effective process of the kind I am recommending here today can we as a nation anticipate and direct change and consequently minimize what Alvin Toffler has aptly named 'future shock.' For more than 2 years my staff and I have been working on this proposal. I consider it to be the single most important piece of legislation of my 25 years of public service."

The bill declares 16 "national goals," including the expansion of the Employment Act of 1946 to achieve the goal of sufficient income distribution to assure acceptable levels of nutrition, health, education, housing and cultural opportunity for all the nation's people. Despite this impressive goal and 15 others, the bill does not focus on specific policies. Instead it concentrates on the process and institutions through which national growth policy would be made.

An Office of Balanced Growth and Development is established in the Executive Office of the President to force the conscious interrelation of decisions by providing for the policy direction and coordination of all federal and federally assisted programs for planning and land use development, and programs designed to improve human resources, allocate resources, and allocate or conserve energy resources within the departments and agencies. The office would also assess national needs, goals and priorities.

To direct the office and assure that all affected departments and agencies take part in decisions, the Council on Balanced National Growth and Development would be created. This council would essentially be a super cabinet and the Director of the Office would be a domestic "czar" who would have to be of the stature of a Nelson Rockefeller with the powers of a John Ehrlichman in order to be effective.

The office would issue an annual report which would include appropriate projections and forecasts regarding future social, economic, environmental, and scientific developments affecting the growth and development of the nation stated in five-, ten-, and twenty-five-year time frames.

Humphrey's bill would create multistate regional planning and development commissions representing the governor and the state legislature of each state in the particular commission. Also it would create a National Citizen's Council on the American Future and a Foundation on the American Future. The National Citizens Council could provide a useful way to encourage state and regional level anticipatory democracy and correlate their results.

In Congress the bill would establish a Congressional Office of Policy and Planning which would "conduct a continuing, non-partisan analysis of national goals, priorities, and urban, rural and national growth policies and shall provide the Congress with the information, data, and analysis necessary for enlightened decisions with respect to such matters." The office would provide "the framework and overview of priority and growth policy considerations within which a meaningful consideration of individual measures can be made."

The bill S. 3050, was referred to the Senate Government Operations Committee when it was introduced in February of 1974. No action was taken during the second session of the 93rd Congress because of a lack of stong interest and some opposition among committee members and the Chairman, North Carolina Democrat Sam Ervin, as well as competing demands of time from other committee action in the Watergate-related activities. Humphrey plans to introduce the bill again later this year.

In the meantime, Humphrey has had the Congressional Research Service prepare annual summaries of national, state, and local developments in the field of growth and development policy. He also had the bill printed and distributed by the Joint Economic Committee before it was introduced in the Government Operations Committee.

The complexity of this bill is evident. There would be much resistance to this on political grounds by those opposed to growth policy—groups similar to those who successfully opposed action on land use planning in the 93rd Congress. There will probably be opposition from those agencies in the Executive branch and committees in Congress from which power might be shifted.

Despite the potential opposition to this bill, the area of national growth policy will be a major focus of legislative conflicts which are of interest to futurists. This is so because it includes the requirements for foresighted decision-making mentioned earlier: providing an early warning function, informing congressmen in their current decisions, and confronting the horizontal linkages across policies.

Possibilities in the 94th Congress

During the 94th Congress the advances described here are likely to continue. The futures unit of the Congressional Research Service will be in operation, and its lists of emerging issues will hopefully become more widely requested and used. The Office of Technology Assessment will continue to provide information on the likely second and third order consequences of potential decisions and will begin to provide an early warning function. The Congressional Budget Office will begin preparing for its first report, and the congressional budget itself may raise a more. thorough questioning of our national priorities and their impact on the future. The Office of Science and Technology will probably be re-established in the White House.

There are other means by which the government could confront the future which have not been considered here. One possibility is the establishment of an Office of National Economic Planning similar to the National Resources Planning Board of the 1930s and 1940s. The earlier organization provided invaluable aid to planning efforts at all levels of government, yet was ultimately legislated out of existence by a Congress angry at the liberal welfare goals being enunciated by the President's bureaucrats in the Planning Board. The lesson is that the ultimate value of planning is in the mind of the decision-maker, or a majority of the relevant decision-makers. The growth policy mechanisms described above could provide the planning and information as well as generate the political support ultimately necessary for anticipatory or controversial planning related issues.

Another approach within Congress stresses the importance of political will and leadership. This would build into the minority and majority leadership offices of both Houses a capability for horizontal policy assessment sensitive to the value preferences of the political parties in each House. The Democratic Caucus in the House has been asserting greater political leadership and there are some attempts by the leadership to present overall programs regarding energy, for example. This broader type of policy analysis would be a useful addition to an active congressional leadership.

The futurist reforms described here deserve greater attention by both political leaders and the general public. If adopted, they can provide Congress with the policy analysis and planning capabilities needed to anticipate problems and thus avoid government by crisis. These reforms are essential prerequisites if the American system of government once again is to function effectively in today's increasingly complex, interdependent world.

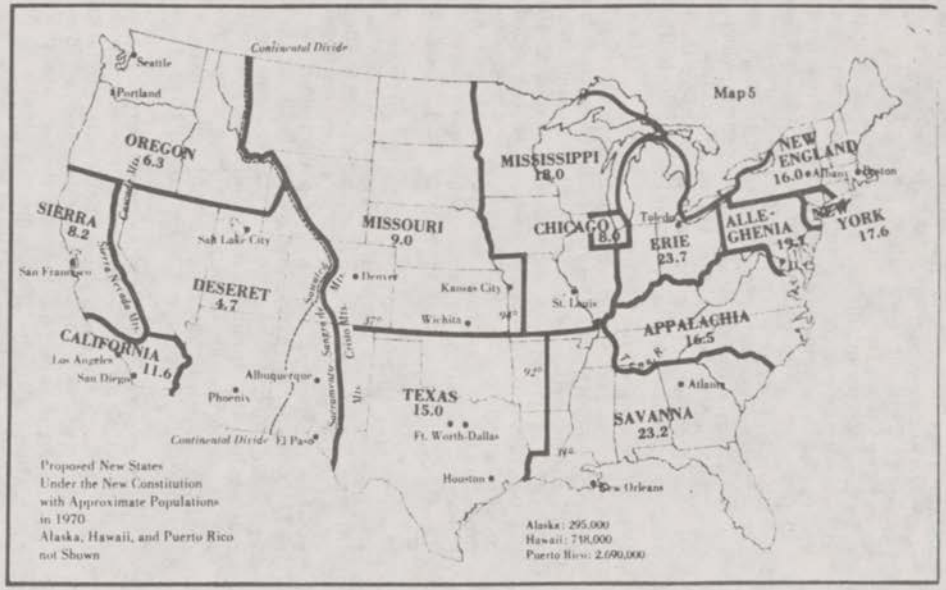
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The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Center for Governmental Responsibility.

SHOULD U.S. STATES BE LARGER?

Thirteen larger states would replace the present 48 contiguous states under a revised U.S. Constitution proposed by a University of Pittsburgh history professor. Leland Baldwin says that enlarged states could handle such present federal functions as "flood control, river navigation, forestry, agriculture, social security, medicare, small business loans, and perhaps administration of the public domain." Baldwin's proposal, one of many current notions for developing a more effective U.S. government, is contained in his book *Reframing the Constitution, An Imperative for Modern America*. Baldwin also proposes a unicameral Congress and a Senate that would supervise the political parties. His revised constitution, contained in the final section of the book, is aimed at forestalling violent dissent and the rise of a dictator in America.

Reprinted (by permission) from *Reframing the Constitution: An Imperative for Modern America*, American Bibliographical Center-Clio Press, Riviera Campus, 2040 Alameda Padre Serra, Santa Barbara, California. 1972.



What Futurists Can Do To Raise Congressional Commitment To Future Consciousness

Author Clement Bezold offers the following suggestions to persons interested in encouraging various attempts at more foresight in government:

A person with special skills or knowledge who is familiar with the relevant congressional committees can offer specific suggestions regarding futures research and forecasting in his or her policy area. All concerned individuals can congratulate their elected officials for their successes (e.g., the foresight provision in the House), and they can urge the passage of further rules or laws to provide a greater anticipatory capacity.

The recipe for more foresight in congressional operations includes the following ingredients:

1. The implementation of the foresight provision by the House committees and the adoption of similar procedures by the Senate committees.

2. A widespread use of the services of the Congressional Research Service's futures research unit and lists of emerging issues by the congressional committees.

3. Futures research by the Congressional Budget Office, particularly regarding national needs and national growth policy.

4. Establishment of mechanisms for setting national growth policy.

5. A desire by individual members of Congress for better futures information for all their decision-making.

6. An awareness among the public of the meaning of "foresight in government," a demand for it from their elected officials, and support when the officials facilitate it.

7. Similar awareness and demands from interest groups, both public and private.

Futurists can congratulate the House for the foresight provision and encourage committee chairmen and members to implement it. They can also advocate the adoption of specific legislation, either by direct contact with members of Congress or by encouraging organizations such as Common Cause, various Ralph Nader groups, and some business or corporate groups to support foresighted measures.

It would be useful if large numbers of citizens let their representatives know that there is a standard of foresighted leadership which they demand as part of the job and encourage politicians when they move in this direction. This will often be a separate question from whether a substantive issue is decided a certain way; rather it will involve the procedures and mechanisms and the future orientation which politicians use to approach these questions. While there may be disagreement among futurists, as among the general population, about how the energy crisis should be solved, there should be shared commitment to mechanisms which will force these kinds of problems to be raised and considered before they reach a crisis stage.

The Foresight Provision

The foresight provision is a little known but potentially very important rule adopted by the House of Representatives which, beginning this year, directs each House committee to do futures analysis. Rule X, section 2(b)(1) of the House rules, states that each committee, except Budget and Appropriations, "...shall review and study any conditions or circumstances which may indicate the necessity or desirability of enacting new or additional legislation within the jurisdiction of that committee (whether or not any bill or resolution has been introduced with respect thereto), and shall on a continuing basis undertake futures research and forecasting on matters within the jurisdiction of that committee."

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