

Human Goals and Science Policy

by R. W. Jackson

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Foreword	7
Acknowledgements	9

I. Introduction	11
II. The Needs and Goals of the Human Individual	21
III. Goals and Systems	37
IV. Goals, Meta-systems and Governments	55
V. Goals, Priorities and Politics	73
VI. Conclusions	107
Appendices	

	111
Publications of the Science Council of Canada	129

Foreword

In 1968, in its Report No. 4, *Towards a National Science Policy for Canada*, the Science Council postulated a set of national goals for Canada in an endeavour to advance a coherent framework within which science policy might be formulated.

The generality of the goals raised little difficulty as to their acceptance. The absence of a statement of priorities, however, left one with little sense of direction, and rendered it difficult to direct a sufficiently specific policy framework. The link between a statement of national goals and a working definition of science policy was still missing.

In this work, *Human Goals and Science Policy*, Dr. Jackson launches a further attempt to develop such a linkage. He starts by reviewing the basic needs and motivations of individuals, and describes how personal goals can be warped or displaced by particular forms of social organization. Within society, decision-making systems develop considerable autonomy and one approach to science policy may well be to consider how science and technology might be used to advantage on a system by system basis. The Science Council studies on Energy and Health Care are examples of this approach.

Bodies such as the Science Council have an important role to play in raising issues of social importance, in describing the potential of science and technology to enhance progress and in drawing attention to possible misuses. Within this context, both the institutionalization and the public discussion of technological initiatives are about as important as their content, and the Science Council must press its case in both these areas until science policy becomes a dynamic element of major social decisions.

In such a context, as Dr. Jackson remarks, "science policy is not a thing, but an activity."

It may be a valuable contribution to the corpus of thinking on science policy to so stress the importance of process.

J. J. Shepherd Executive Director Science Council of Canada

Acknowledgements

The study is unabashedly interdisciplinary. To some professional or academic specialists it may seem variously elementary, unscholarly, uninformed, or downright mistaken. Political scientists, psychologists, economists, philosophers, systems analysts may rush to defend their proprietary domains against this brash intruder. All of that cannot be helped and I make no apologies. The only workable method for interdisciplinary synthesis is postulational, that is to make the attempt as I have done and then count on the specialists to come forward with constructive criticism. This I hope they will do. I owe thanks already to several colleagues who have responded generously in this way. I would particularly like to thank Tom Settle of the University of Guelph, Bob Gibson of the University of Toronto, Dixon Thompson of the University of Calgary, Jon Alexander of Carleton University, and Peter Larkin of the University of British Columbia and Member of the Science Council, for their considered and constructive comments. To the Executive Director of the Science Council during the period of this work, Patrick McTaggart-Cowan, I am thankful not only for his helpful comments but for his patience and continuing support of a work that must at times have seemed far removed from practical science policy concerns. My thanks also to our editor, Aileen Shaw, for her devoted care in seeing this somewhat unorthodox layout through the printing process.

R.W.J.

I. Introduction

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In spite of many declarations on the importance of relating science policy to national goals and/or social goals, the way in which it can be done has remained obscure. This study is an attempt to explore the connections between personal and social needs and aspirations, and political decision making in a pluralistic democracy, especially in matters affecting or affected by science and technology.

The study is properly termed an exploration, or a foray, into the subject because it cannot claim to have bagged its quarry and put it clearly on display. In fact the reader may feel when through that he or she has been led into a jungle and left to find his own way out. One can only hope that an understanding of policy-making processes will have been improved by the experience.

The definition of science policy used is a broad one, covering not only policies for the nurture of basic science, but policies for its application, policies for the consistent development of technological infrastructure, policies for the control and correction of undesirable impacts of technology, and policies for the use of expert knowledge wherever appropriate to improve the quality of decisions in the society. In short, science policy in its broadest sense is concerned with bridging the gap between the specialized expertise of science and technology (both broadly defined) and the non-specialized private and social goals that the political process seeks to serve.

The idea that there might be a need for science policy probably first arose among scientists, who felt they alone understood the great potential value of their work, and found themselves, relative to that potential, insufficiently supported and inappropriately used in the national scheme of things. Wartime helped to convince politicians that it was so, and thus one theme behind the establishment of structures for science policy was set in motion in 1916 in Canada, with the formation of the Honorary Council for Scientific and Industrial Research. This came to be called the National Research Council. Later another theme entered and was beginning to be heard by the time the Glassco Commission on Government Organization made its recommendations for new science policy structures in 1963.* This theme was a concern that science and technology were bringing about massive changes in the society, were calling for massive expenditures, and needed to be brought under some form of social control. Thus both themes were in evidence through the period of formation of the Science Secretariat of the Privy Council Office (1965), the Science Council of Canada (1966), and the Ministry of State for Science and Technology (1971).

When the Science Council first set about to organize its task, it realized that its mandate as a national body advising the

^{*}Canada, Royal Commission on Government Organization, Chairman, J. Grant Glassco, Information Canada, Ottawa, 1963.

Government in the public interest required it to rise above simply promoting the interests of the scientific elite, and above simply promoting technology for its own sake – that is, simply responding to the enthusiasms of the scientists, engineers, and technologists involved in one or another area of development. Its task had to be placed in the context of national purpose.

However, in the Canada of the 1960s a national purpose was not obvious. Even the goal of surviving as a single nation seemed to have something less than a complete consensus. The paradigm that most people had in mind when they spoke of national goals was carried over from the experience of wartime, when the goal of winning, or surviving, had overriding first place, and all political decision making focussed around it. Perhaps policy makers hankered after those simpler more straightforward times, finding the diversity of peacetime concerns confusing.

Then, too, there was an awareness that Western society, in general, had been passing through times of widespread and radical change over the past two or three generations. The causes were rooted in technological change, political change, and a fundamental economic transition from material scarcity to potential abundance. The wide availability of education had been having its effect, and demands for participation were being heard from constituencies that had formerly been incoherent and inarticulate.

The stability of the society and its institutions was being threatened. As long as a society seems to be on a reasonably steady course to somewhere (other than imminent disaster) its citizens do not tend to worry much about just what course that is, or who is steering (if anyone). But let shoals be sighted, and questions begin to be asked. In the sixties, we began to sense with growing urgency that we might be approaching limits to the supply of certain resources, or to the capacity of the environment to absorb our waste products; we began to sense ourselves at the brink of possible technological, economic, and ecological disasters, brought about by the single-minded pursuit of efficiency and material affluence. Governments seemed to move forward more by a process of backing away from crises than by any pursuit of positive goals. Most of that characterization of the sixties still holds today.

When a scientist begins work in an area where the data seem confused and contradictory, he normally forms a tentative hypothesis, or tries one after another until he finds one around which the data begin to make sense. It was essentially that approach that the Science Council used in Report No. 4, *Towards a National Science Policy for Canada.** For lack of any explicit statement by national leaders, a set of national goals was postulated and published. If it did nothing else it would lay bare for

^{*}Science Council of Canada Report No. 4, Towards a National Science Policy for Canada, Information Canada, Ottawa, 1968.

inspection the major premises and preconceptions of the Council. More constructively, it was hoped that under criticism the statement of goals would be improved and modified until it might begin to serve as a reasonable common ground or working hypothesis for science policy discussions between the Science Council and its various publics.

The principal goals listed were:

- National prosperity
- Physical and mental health and high life expectancy
- A high and rising standard of education, readily available to all
- Personal freedom, justice and security for all in a united Canada
- Increasing availability of leisure and enhancement of the opportunities for personal development
- World peace, based on a fair distribution of the world's existing and potential wealth.

These goals were then broken down in somewhat more detail into elements or sub-goals.

The postulated framework of goals seemed to find a fairly wide consensus among those Canadians who read the report - or at least an absence of substantial disagreement. What disagreement there was left largely unquestioned the substance, but focussed mainly on the legitimacy of the Science Council, or even its presumption, in making such an attempt on the public behalf. Save for the recommendation by one of the Council's own study committees, that an additional goal be added, "the preservation and improvement of the natural environment", there has not been as much public response or discussion as the Council would have liked. In retrospect, perhaps one reason is clear. The suggested goals not only seemed almost unarguable, like the virtues of motherhood, thrift, and peacekeeping, but it was not clear that they implied any particular course of action. Until one sees definite priority choices implied, and potential decisions that could affect one's welfare, one tends to take such declarations no more seriously than the flying of banners on May Day.

Not only from the public viewpoint, but also from the viewpoint of the Science Council, the list presented difficulties. What is the procedure for deriving science policy from such goals? If the goals are meaningful, we might reasonably look for consequences in action. To put it another way, regarded as scientific postulates they should be expected to have traceable connections with the real world of experiments, decisions, and verification. The Economic Council of Canada, too, noted the problem when it said in its *Eighth Annual Review* "while such broad generalizations may achieve wide acceptance as principles, they do not provide operational guidelines for policy formation."*

^{*}Economic Council of Canada, Eighth Annual Review, Design for Decision-Making, Information Canada, Ottawa, 1971, p. 66.

The number of statements of general principles that can be made – or at least the number that can be made before their audience drifts away – is limited. The challenge of translating them into the arena of practical politics cannot be ignored. The difficulties then appear. There is a notable gap between general decision-making criteria expressed as national goals, and criteria of the type used in day-to-day program and budget decisions by government agencies and treasury boards. There is another gap between the so-called national goals and the private goals and preferences by which an individual citizen lives from day to day.

All of us find it difficult enough, as individuals, to add up all the various satisfactions and dissatisfactions we encounter in the pursuit of our personal aspirations. Does a given individual consider his or her overall quality of life to be good, bad, or indifferent? How much more difficult may it be, then, to devise indicators by which a whole society can measure and judge whether the conditions of life it provides for its citizens are improving or getting worse. Yet without such indicators to tell us whether we are approaching or veering away, what sense can we give to the idea of steering toward goals?

Until these gaps in our understanding are bridged, the development of science policy will be full of frustrations and false expectations. Those trying to write policy will attempt the superhuman, and those looking for policy advice will expect the impossible. With sufficient art, granted, writing about science policy can almost always be made to sound important and profound, but it may come across to the decision makers with no more transparency than the pronouncements of the Delphic oracle – "it sounds like wise advice, but what does it tell me to do?"

Already we have probably been building up false expectations by discussing *science policy* as a *thing*. By using the words often enough they begin to take on a solidity that may be quite illusory. Far from denoting a monolithic structure that can be worked out and formalized on paper, science policy, we shall find, comes closer to denoting an open-ended set of continuing activities – a general area of involvement with many policies.

To build an understanding of the rather complex assembly of systems and politics that is our society, this study begins by going back to first principles, reviewing the basic needs and motivations of the human individual.

Chapter II, therefore, abstracts from various sources a "reminder list" of fundamental human needs, goals, values, drives, and motivations. All these words are put together in an indiscriminate way because, although they must have been introduced to the language to convey distinctions useful for one purpose or another, the concept that they share rather than any distinction they make is relevant in our present context. If, for example, a person's goal should be as vague and general as "a good quality of life", we find that it would be made up of many different ingredients, each person preferring ingredients in different measure. The ingredients would include the embodiment of certain values to be upheld or not contravened, as well as the satisfaction or prospect of satisfaction of various material and psychological needs – including among the needs, perhaps, the need to be motivated or to have goals. It will not serve our purpose to spend our mental energies peeling the onion of psychological analysis, layer after layer; that part of the task will best be left to others. Chapter II will fulfill most of its aims if it impresses and perhaps surprises the reader by the length of the list of essential ingredients (incomplete though it undoubtedly is), and by the diverse, idiosyncratic, and sporadic nature of many of the ingredients, particularly in the psychological sphere. One might also be led to wonder how it can be that people seem to be happy as often as they do.

Chapter III treats the social apparatus people have created, over centuries of evolution, through which to pursue their goals, individually and collectively. Many systems and institutions can be identified, including economic market place systems, political systems, bureaucratic systems, legal, educational, welfare systems. The basic list in Chapter II helps to identify the principal types. This approach in terms of systems is useful because it draws attention to the ways in which people get caught up in and organized into the systems of the society. To the extent goals are determined by what is feasible, goals are shifted and interpreted in terms of the systems. To the extent people identify themselves with one system or another, they tend to reinforce the power of that system and make its goals their own. Thus, many of the fundamental goals of individuals are warped and displaced by the rigidity and the momentum of the forms of social organization and the co-option of those forms by powerful elites.

The systems interweave and overlap, and interact and interfere, but also often have considerable autonomy and independence. The output, or the total activity of a system, often measures the aggregate of individual demands and priorities of a certain type (the market system is not the only system that responds to demand – the enrolment in a new type of school, or the subscription to a new form of medical treatment might be an indicator of a previously unsatisfied need). Sometimes, unfortunately, the mistake is made of turning that aggregate of individual choices around and interpreting it as a "social goal", as nations tend to do with economic indicators such as the Gross National Product. Sometimes, indeed, the procedure may have some validity. But, more generally, it contains a dangerous fallacy of logic. The aggregate does not reveal the paths back to its multiple origins, and therefore a government that simply makes a *target* of the aggregate can do many wrong things that do not correspond to what people would have freely chosen. It would seem that the only feasible and proper procedure for a situation where

values and needs are diverse and centres of decision pluralistic is to regard the effective functioning of the system itself as the social goal.

The relationships between private and social goals are complicated, perhaps recognized as more complicated since Arrow's celebrated Impossibility Theorem for Ideal Democratic Resolution of Divergent Preferences (1949–1951).* Some of these complications are indicated in this study but a thorough exploration has had to be left to be done elsewhere or at another time.*

The systems language is useful also for allowing the introduction of concepts such as feedback, cybernetics, and computer modelling, that are now providing new insights into the types of response characteristic of complex interrelated "goal-seeking" social systems, and therefore promise a new predictive power to some aspects of policy analysis. The need for coordination of the activities of systems – the need for policy – introduces a concept of governance, through meta-systems, that is inclusive of but broader and allowing for more varied forms than the usual concept of governments.

Chapter IV seeks to clarify the roles of governments in respect of these various systems. Ordinarily it is thought that something called "the government" stands above and governs all; but, in practice, there are several levels of government, and various types of meta-systems exerting governance in different ways. Many of the social systems, once institutionalized, function semi-autonomously, each with some sort of internal management structure. The governments proper may operate or administer the separate systems, they may stand aside and act as referees, rule-makers, and regulators, or they may actively intervene, coordinate, and negotiate policy, making higher "meta-level" sense out of the competing, mutually interfering, and narrowgoal-seeking activities of the separate systems. The mode by which a meta-system exerts influence may be through legal

*K. J. Arrow was awarded the Nobel Prize for Economic Science in 1972, in large part for his work in establishing a logico-mathematical basis for the theory of social decision making. This work, Social Choice and Individual Values (2nd edition, Yale University Press, 1963) when first published was a landmark in a continuing concern about certain paradoxes inherent in the procedure of democratic voting, a concern going back at least to Condorcet (1785). Briefly, if social choice is to depend only on aggregating the preferences of the individuals in the society, "there is no democratic constitution, no matter how complicated, which can always be sure of producing a method of social choice that satisfies certain ordinary properties of coherence." The usual expedient way out, of acting on the majority vote, may in fact turn out to be unsatisfactory to most (especially when the vote is distributed among three or more options). Arrow's work thus raises serious doubts about the practicability or the validity of governing by referendum, or basing government decisions directly on the apparent preferences of voters.

⁺The problem of relationships between individual preferences and governments is also discussed in greater detail from another point of view by Tom Settle in *In Search of a Third Way*, McClelland and Stewart, Toronto, 1976. authority, backed up by a judiciary system and military force, or it may be economic or, increasingly, it may be through the medium of information and knowledge. The functions of various new bodies in the science policy realm, such as the Science Council of Canada, the Ministry of State for Science and Technology (MOSST), the Institute for Research on Public Policy, and so on, are best understood in terms of the latter mode.

Where institutions have considerable semi-autonomous power as, for example, large business corporations, governments often find themselves acting, not as all-powerful sovereigns, but as somewhat comparable powers entering into diplomatic negotiations. In fact, many decisions that amount to science policy of national scope are made by private corporations - constrained to serve the general interest, so it is said, through the voting mechanism of the market. Some major defects of the market. however, particularly when dominated by a few large buyers or sellers, (along with the consideration that it expresses simply the aggregate of many decisions made from narrowly self-interested points of view), lead to the recognition that the pure free-market economy cannot unaided accomplish the aims of the good society. Problems arising from the unmoderated or unenlightened pursuit of private goals, such as pollution, urban traffic, and corruption of nutritional quality - problems arising from the pursuit of "micro-motives" - are discussed in this chapter.

The point of a *meta*-system is that it exists, not simply to *repeat* the functions of the systems it comprehends, but to *add* its own level of coordination, governance, or policy. Thus it tends to develop a *language* of terms appropriate to its level of working and in that language to express its own "meta-goals". Governments, then, not surprisingly, work in terms of particular kinds of goals or general criteria which are not simply the aggregate of individual desires. Yet, in a democracy they are subject to being approved or endorsed by the electorate. Comparison of several listings of "national goals" suggests that there may be a fairly universal set characteristic of modern democracies, possibly even of humanity as a whole. The suggested list of general goals, principles, or values includes:

- Preservation of the nation (or *national sovereignty*)
- Expansion of opportunities for human development
- Optimization of *freedom* and *human rights*
- Assurance of justice and equity
- Improvement of democratic participation
- Maintenance of stability with progress
- Preservation or encouragement of *diversity* (within national unity)
- Taking thought for the whole, and for the future.

The pairing of some concepts helps to emphasize that these goals can conflict, and policy has to compromise. The goal of maximizing human development, for example, as an individual may see it in terms of his or her own development, may conflict with the rights of others or with the good of the whole.

The goals listed by the Science Council in Report No. 4 can be seen to have a similar character, modified to some extent by present Canadian perceptions and system biases. Whether the set suggested in this study is regarded as an improvement is largely a matter of opinion, since it is somewhat arbitrary which concepts are taken as basic. However, to indulge in a brief comparison, prosperity, health, and education in the original list have been removed from primary status, as goals for their own sake, to be included among the conditions for human development. World peace has been subsumed mostly under stability. Personal development has been removed from association primarily with leisure, allowing for the possibility that much of it also occurs through the experience we call work. Environment becomes an aspect of concern for the whole. In any case, the near universality of these lists means that controversy is likely to occur not over the lists themselves, but over the relative priorities.

In Chapter V, we attempt to carry through the analysis into the domain of practical politics. Faced with the diversity of individual preferences (Chapter II), the variety and semi-autonomy of systems (Chapter III), and the government's own set of operating values (Chapter IV) among which compromises have to be made, what in fact does a government do? How do governments cope, in practice, with decision-making problems of such magnitude and intangibility? Certainly governments do not in fact do annual "zero-baseline" assessment of priorities. Attempts at quantitative techniques of cost-benefit analysis, plannedprogram-budgeting, and such, are not workable for the society at large to more than a very limited degree. The pragmatic solution that governments use is to assume that on the whole the society is operating satisfactorily, running itself, so to speak. Current governmental resources are largely locked in to a continuance of established programs and past trends. With the limited degree of freedom at the margin, governments then decide how it shall be allocated – patching here, revising there, and venturing into a few cautious new constructions. The list of working priorities appears in political platforms, speeches from the throne at the opening of Parliament, cabinet programs for legislation, and so on. However, although policies of incremental change, and reaction to one crisis after another are what we expect of governments, we have the right to demand that government live up to its meta-system role, which would require it to be venturesome, experimental, solicitous of the well being of the society as a whole, and to plan for the long-range future.

Throughout this study concern for science policy is constantly present. In Chapter II, we are reminded of some ways in which technologies have greatly shifted the marginal priorities or utilities (depending, still, on individual economic status) by

greatly facilitating the satisfaction of some needs, while sometimes putting obstacles in the way of satisfying others. In Chapter III, it becomes clearer how science and technology have transformed some systems, and offer many opportunities for the improvement of others. At the same time, as power, technical complexity, organization, and impact grow, new systems come to be needed, for example, research and information systems to help consumers make intelligent choices, systems to monitor and protect the environment. As a result of "solving the production problem" in the Western industrialized countries, one can discern a general shift in priorities from emphasis on production and "economic growth" to emphasis on reducing the inequities of distribution, or improving social participation (reducing alienation and poverty). This shift is evident primarily in Chapter IV. Finally, in Chapter V we see how the raising of issues by bodies like the Science Council, and the revealing of opportunities for improvement of systems, come together with political considerations to influence final government decisions and priorities for action. This completes the attempt to explore and sketch out the pathways from the original basic human needs, through social or national goals, to policy implementation. The nature of operational science policy as it relates to and embodies social goals may then appear rather complex, but it will be closer to the truth. It then may be hoped that science policy will have been brought closer to being understood as a practical political art.

Since this introduction was written *after* the main study, some concepts may be pulled together better therein than in the main text and the reader may find it makes sense, if he or she has the patience, to return to read it again in place of a comprehensive concluding chapter.

II. The Needs and Goals of the Human Individual

Before discussing national goals, it is useful to begin by reviewing the needs, goals, and values of the individual. Too often we launch into discussions of policy issues at a level of abstraction that, while it recognizes that policy must be founded on human goals and values, nevertheless refers to those goals and values only in the form of scattered instances for illustration, never in a systematic way. The danger can be that the policies recommended endorse implicitly a set of goals that have no more social or psychological authority than that they have been mentioned frequently in recent conversation. Alternatively, the recommendations may assume a unanimity or consensus on priorities that does not exist in the populace.

How often have we heard the lay philosopher and afterdinner speaker simplify a problem into absurdity by arguing from the case of the starving man. From this case, it is supposedly "obvious" what the order of priorities should be for the industrially developed affluent society. In this study, we attempt to establish a better basis. We condense it in the form of a "checklist" which appears in the margin to the right, as a running counterpoint to the general discussion in the text. Also in the margin will be found references for further reading and "asides", original and quoted.

In putting together such a checklist, we are fully aware of Maslow's warning, that all attempts to make atomistic lists of drives, motivations, or needs are foolish, for always behind one drive others are to be found. A deeper psychological analysis may reveal that a certain person's apparent hunger for food is really a symptom of an unsatisfied need for love, and behind that may be found deeper levels of explanation in Freudian or other terms. Maslow likens the situation to a nesting series of boxes; each box contains one or more smaller boxes, which in turn contain more boxes; furthermore, some boxes in some sense may contain each other.

We are also aware that ultimately we shall have to distinguish carefully between the understanding of behaviour and the politics of behaviour. No matter how well we feel we understand the other person's actions, no matter how much of a society's behaviour we "explain away" in terms of "real" needs, hidden drives, we are still morally bound to accord to the other person just as much of a right as we do to ourselves, to hold his or her private views and to pursue his or her idiosyncratic preferences. While knowledge may enlighten policy, it must not displace human dignity or democratic process.

However, we need not be put off by fears of complicated issues, for the purpose here is relatively modest. We do not propose to attempt a complete motivational analysis of human behaviour, useful though that might be some day, but only to move toward it, on some middle ground, away from the point of naïve over-simplification. *Needs* will not be explained in terms

A.H. Maslow, Motivation and Personality, Harper and Row, New York, 1954. of other "deeper" needs, but will simply be pointed to and listed, to indicate the range of the human spectrum. Nor shall we pretend that the list is complete or exhaustive. It will be illustrative at best, but extensive enough, we hope, to get past the point of superficiality and casual instancing.

The detailed ordering of items carries no particular significance, although toward the beginning some attempt has been made to follow Maslow's ordering, or *hierarchy*, of basic needs, simply as an aid to comprehension. Maslow's hierarchy runs as follows:

The Physiological Needs The Safety Needs The Belongingness and Love Needs The Esteem Needs The Need for Self-Actualization The Desires to Know and to Understand The Aesthetic Needs

Maslow emphasizes that, although there is a general tendency for each type of need to come to the fore as the "lower" needs are taken care of, all types are present simultaneously in a given individual, at varying levels of excitation, awareness, gratification, or deprivation. There can be wide variations of the ordering, from one individual to another, and wide shifting of the priorities within one individual, as a function of time and situation, even from one minute to the next. To see a pretty girl walk past can make some men forget almost anything.

Clean air to breathe is an example of how even the most A CHECKLIST basic needs can go unrecognized. Perception of need is a subjec- OF NEEDS tive affair. We may not realize we need something until it is gone. Water and other natural resources share some of this character. Water, a basic physiological need and, in many societies regarded you've got 'til not only as necessary for drinking, and growing things, but also ______Mitchell for washing, shows how a basic necessity when in plentiful supply can be elaborated upon to serve other purposes. Water is not Water simply drunk straight, but gets elaborated into many varieties of beverages - sweetened, flavoured, alcoholic, and proteinaceous. Washbasins progress to bathtubs, showers, swimming pools, and public fountains - not just for washing but for fun and games. aesthetic pleasure, and status display. Lakes, oceans, and canals are not only fished in for survival and used for essential transportation. They are also fished in, boated upon, swum in, and skated on for sport, explored by scientists, and gazed upon to rest the mind. Sunshine, often taken for granted, is a source of Sunshine vitamin D, necessary for health. Human survival underground would assuredly be possible, through technological substitutions for sunlight, but hardly desirable in most people's eyes.

Food, the "classic" basic need, can illustrate characteristic Food (nutrition) features of all basic needs, drives, or appetites such as satiation, qualitative improvement, aspiration overshoot, and elaboration

Air

"You don't know what it's gone"

into other purposes. Past a certain point more food is not a benefit to the organism but a liability. Yet aspirations, a habit of hunger, built up through a history of scarcity, can cause a person, or an entire culture, to overshoot the point of sufficiency and carry on into the region of over-indulgence and the diseases of obesity. This is besides, or in addition to the elaboration of the mode into the gratification of other needs or desires, including the indulgence of sensory pleasures. Haute cuisine might be defined as playing upon the original appetites or drives physiologically built into the human organism to engineer survival. A puritan would frown upon it. But the French would say, "Since we must eat why should we not make it a pleasure and an art while we are about it? - surely that is more efficient than to gulp a tasteless package and then set out to satisfy our pleasureneeds." Why indeed should we build cheap ugly buildings and streets to walk amongst most of our days and build somewhere else a place for art?

At times, of course, the aesthetic component overswings. "Taste" dictates that California ranch-style housing be imported into cold parts of Canada. Tall office buildings are built to satisfy decorative criteria or megalomania, and may not function inside. Fashion produces high "winter" boots that cannot be worn in slush. To err on the side of too much is as bad as too little. The Middle Way may be hard to find.

So we continue, noting basic needs such as food, shelter, clothing, and noting at the same time the multi-sided ways in which the whole human being has tended to go about meeting those needs. Even the meanest householder feels the urge to decorate the walls somehow, or to express himself or herself through choice of clothing styles. We note also an element of *symbolic* activity. A stated need is not always what it seems. As an individual succeeds in raising his level of income he may buy, ahead of many other things (which he should have the sense to buy first) an automobile of a certain make, or an oil painting, not because he is a fast driver, or gets the slightest bit more aesthetic pleasure out of an oil painting than out of a calendar reproduction, but because they have become for him *symbols* of a status to which he aspires that will satisfy an achievement need.

Through all this run problems of definition. Is there a significant difference between a *necessity*, a felt *need*, a motivational *drive*, a *desire*, an *aspiration*? Where does one draw a line between *necessities* and *luxuries*? Once one admits that psychic needs are real (often desperately real) one has to conclude that all boundaries are relative. As any medical practitioner will testify, a clear line between physiological and psychological needs is impossible to draw. Thus we see no definable basis on which to distinguish between essential needs and what might be called *desiderata*, except on a purely relative scale. Hence we shall carry

Shelter

Clothing

on using the words more or less interchangeably, letting the list speak for itself.

An example of the relativism of definitions is health care. Health Care In the first instance, of stark human survival, there is no question but that first priority goes to the curing of wounds and disease, and protection against poisons and infectious organisms. If a tooth hurts, it is pulled out. If mental breakdown occurs, the person is ostracized. Criminals are killed or locked up. But at a higher level of social development, preventive medicine is reckoned essential. Positive physical fitness is encouraged. Crooked or missing teeth are regarded as bad for the health and psychologically traumatic. Eveglasses are a basic need. Psychological counselling and psychiatry are given a higher priority. Contact lenses, orthodontistry, and cosmetic surgery come to be reckoned as important for social survival. And, as technology advances, heart transplants, artificial kidneys and other prosthetic mechanisms become essential to the survival of some individuals and therefore rise very high in at least their scale of priorities. As long as it is only an unrealized possibility, a device like a mechanical heart may be given a relatively low social priority, but as soon as it is developed and available it may suddenly be regarded as a necessity. Thus, out of research and development can come severe problems for economic allocation. Moreover, new technological possibilities can exert a glamour that draws people's minds away from attention to more mundane investments where, from a cost-benefit point of view, their resources would be better spent, as in recreational programs or in nutritional research.

Sometimes the need is not so much for a single component Exercise and Rest as for a complementary pair. For example, an appropriate alternation of exercise and rest is essential to the health of the organism. The pattern applies not only at the muscular and circulatory level, but also at the hormonal or biochemical level, in a need for nervous or emotional excitement or tension, alternating with relaxation or tranquility. At the physiological level, sex, Sex though it tends to seize the limelight, might be identified as but one of these hormonal modes. The series might be carried further, to the "moral" level, with identification of a need for alternation between modes of discipline and freedom, work and Work and Play play. An absence of these alternations is likely to result either in nervous exhaustion, or in dullness, flabbiness, weariness, and boredom. Some affluent and urban environments tend to an excessive emphasis on stimulus - on activity, things, and noise at the expense of the necessary complements of peace and quiet. Other urban environments, temperature and humidity regulated, served by elevators and escalators rather than stairs, may excessively remove physiological stimulus, to the individual's long-term detriment.

Mobility, through various modes of transportation, must be Mobility

regarded as a basic necessity in most technologically-developed societies, as currently structured. Under primitive conditions running and walking on foot often suffice for the search for food, and for self-preservation from enemies. In more specialized societies, travel at greater speed and over greater distance has become essential for seeking education, employment, for daily commuting from home to workplace, and for trade. Here one could raise the question whether it is an inherent basic need or a created need. Could the society be organized another way, around different technological solutions? If there is no turning back, the question is academic; what was originally optional has become a necessity.

An aspect of the physiological can be termed "species needs". Procreation is clearly necessary to ensure survival of the species, and the concept of procreation can be broadened to include the existence of the family or equivalent social structure for protecting and rearing the young. The priorities of the short term and the long term enter the picture. In the short term, a sufficient number of individuals must be reared to puberty; for survival in the longer term the quality of the genetic pool must be protected. Ultimately, which condition can be regarded as less important than the other?

It would be artificial to treat the needs of a human being as if he were an isolated and self-sufficient individual. Man is a social animal. Most of the advantages he has gained over the primitive state have been gained through social collaboration – mutual help, and specialization of social role, (e.g., hunter, warrior, mother, farmer, organizer.) Technological development has tended to bring a more and more specialized differentiation of role, to the point where individuals may lose their sense of relevance to human needs – they may lose appreciation of their relationship to the system and their feeling of usefulness within it. But technologies differently designed can enhance rather than narrow the social span of the individual – they can free him for human relationships, rather than enslaving him as a cog in a machine – and it may often be that technological systems have been developed with the wrong goals uppermost.

It is often assumed that all human beings are motivated fundamentally by self-interest. Even if that should be the case (and sometimes it requires clever twists and turns of argument to maintain that assertion), there are many situations where an individual finds himself a member of a collectivity. He may originally have joined because that was the only way to obtain something that he himself wanted, but once joined, whether it be a football team, a ship's crew, a community association, or a nation, he comes to be motivated by a concept of *membership* to act in the collective interest, even at the cost of his own convenience or even of his life.

Man (male and female implied throughout) is not only a

Is a need created by the social structure a basic need?

Procreation

Social Collaboration

Useful Social Role

"Ours is a progressively technical civilization committed to the quest for continually improved means to carelessly examined ends."

-Robert Merton, foreword, in Jacques Ellul, *The Technological Society*, K n o p f, N e w York, 1964.

Altruism

-charity, philanthropic urge, desire to help others.

Membership

social animal, but a thinking animal, and a tool-using animal. Access to Tools Thus it is hard to conceive of modern man surviving, in any reasonable sense of "survival", without the use of at least some basic tools and technologies, and without the use of his "mental tools" - reasoning power and symbolic language. Acquired knowledge about the world is an essential tool for survival and since, in humans, it is transmitted mainly post-natally rather than genetically, the process of *education* is a basic need, related to Education the survival and procreation of the species, let alone to the survival and continued progress of what we call civilization. Although very closely related, communication should probably Communication and be separately noted as a need of the social individual. Countless cases of violence throughout history have arisen because of misinformation, inadvertent or deliberate, on both sides, and many present social disorders arise from misuse or inadequate design of ever-expanding communications technologies. The individual needs to know what is happening in his social environment and to communicate with it, but if the messages confuse and distort more than they inform, and if there is no way to feed back, the result is likely to be psychological breakdown. "Is the world crazy or am I?"

The need for education, knowledge, and communication goes far beyond their utility, however, as Mumford so insistently Lewis Mumford, The reminds us. An outstanding characteristic of humans, as distinct Myth of the Machine, from (other) animals, is the urge to play with symbols - to World, New York, explore the environment, to acquire knowledge for its own sake, 1966. to express oneself in art, language, dance, and ritual. Culture, therefore, is much more than a set of useful tools, and citing education and communication only in that context would risk seeming to underrate their importance in the scale of human priorities.

The need for security has many facets, from the most Safety, Security elementary protection from predators, enemies and criminal elements, in the home and on the streets, to a protection against psychic insult - threat, ridicule, and defamation. The individual "Security is the feeling feels a need for social and economic stability, which he or she that nothing can ever seeks through property rights, employment rights, insurance, savings, family relationships, friends and social status, and governmental policies. He needs protection from arbitrary acts and injustices; thus he seeks legal protection against exploitation and oppression by people in power, including the security forces Justice themselves - the police and the military. He or she wears clothing primarily for protection against the climate, but may come to feel also that it provides protection against various forms of aggression from other human beings, and may feel threatened and defenceless walking around nude in a public place. Similarly the citizen may feel threatened by the idea of exposing personal Privacy information in a computer data bank, accessible to unknown people. An aspect of security is the provision of welfare aid. Welfare

Information

Harcourt, Brace and

go wrong" -The Talon Zipper Co.

Almost every society accepts some responsibility for its weaker members – the very young, the aged, the handicapped, and others incapable of roles in the economic system. Technological development tends to bring a greater degree of social interdependence (which unfortunately people are not always aware of, owing to certain alienating tendencies in the way some technologies are applied) and at the same time the greater specialization brings problems of structural unemployment. Both tend to imply a greater emphasis on welfare assistance in the modern state.

Human beings would hardly be human, nor would they develop their capacities, if they did not welcome an element of challenge in their lives. Challenge used to be thought of, for males at least, in terms of going off to fight a war, pioneering in a strange country, or climbing Mount Everest. Today we take a less materialistically simple point of view, and recognize the validity of internal challenges. The introspective exploration of psychological states, with or without the aid of drugs, can be fraught with risks, and can be "character-building" and satisfying for the survivors. Musicians can face real challenge in trying to bring off a great performance of a symphony. Such a challenge, in its demand for concentration, skill, and emotional involvement - and in its subsequent exhausted but satisfied feeling of accomplishment - can exceed by far anything many people find in a lifetime of office jobs or factory work. Thus, though it might seem in some way less productive, might not the musician's work be in some way more humanly *important*?

Many people who otherwise find an absence of challenge in their lives, find compensation directly or vicariously in sports. The roughhouse in the Canadian game of hockey comes as much from the spectators as from the players. The gambler places his money on the line in order to subject himself to peaks of anxiety and excitement (a need noted also under "stress and relaxation").

Another value or need, somewhat related, is for a feeling of exuberance or creative enthusiasm. Man *enjoys* his capabilities, and enjoys exploring their limits. He or she shows off his or her physical prowess in the Olympics. Humans are not content simply to use their language to communicate facts, but must *play* with it, in poetry and drama. Man does not just talk, he *sings*. He does not just play tunes, he writes symphonies. He explores the universe for its pure intellectual interest. With his technologies he does not just build houses, but he builds temples, pyramids, cathedrals, and rockets to the moon. Thus, though it is popular these days to speak of bringing technology under social control, we must reckon with the creative urge. If we want the services of competent and imaginative engineers we must be prepared to allow them some extra scope. In scientific research, we refer to it as the pursuit of excellence – excellence

Is alienation inherent in technology?

Challenge, Stress

-the stimulus of meeting problems to overcome

Achievement

-the sense of success of meeting goals, of overcoming challenge

Excitement

Relaxation,

Contentment –absence of stress

Aggression

-opportunity for interpersonal conflict, pitting oneself against others, competition

Play

-"purposeless" activity for the fun of it; joy of life.

Creativity

-the feeling of creating or originating something leading the way beyond the call of duty. To return to the musical analogy, it is not hard to imagine what kind of indifferent musicians we would get, and what kind of café music, if we insisted that musicians be allowed to play nothing but café music, day in Freedom and day out.

As always, of course, there is the possibility of excess, and the creative exuberance can carry into an excessive confidence. pride, even arrogance in the possibilities of technology, leading to the classically familiar tragedies of hubris.

Our North American cultural tradition places great store in the values of novelty, innovation, enterprise, and personal expected, the innovafreedom. Yet the person who endlessly seeks novelty and nothing else is judged mentally ill. Everyone needs some stability in life. If we look closely we see that innovation is an unusual and a minority activity; the new would be invisible were it not that most things tend to stay the same. If there are leaders of enterprise there must be followers. The exercise of freedom by one person generally interferes in some way with the freedom of -sense of power, resothers, therefore it ought always to be tempered with responsibility. It is fortunate for the stability and harmony of society that many people in many matters prefer the freedom of not having to make choices or carry responsibility. They find a form Discipline and Order of security in living disciplined and ordered lives. Again, all one and none of the other would be unhuman or pathological.

Most of the basic needs recounted above are related to survival of the human individual. An aspect of survival of the human individual, in a very real sense, is the maintenance of personal identity. Most of the time a direct relationship between man and God, or between the individual and the Universe, seems not enough. People seek to shore up their frail egos by giving themselves added definition in terms of status or role in the Self-esteem social system, or in relation to some identity larger than themselves, but more conceptually manageable and tangible than a transcendent Deity. They partake in cultural identity, urban identity, family identity, national identity. They join clubs, communes, and associations, and they seek to stabilize their identities -recognition by society against change by creating institutions and traditions and by tracing family trees. Against the threat of de-personalization by certain types of technology, and by monolithic bureaucracies, such activities intensify.

Although in some sense sheer survival must have first priority, survival in itself is never enough. And people often say, "under such and such conditions life would not be worth living." One such condition might be a total absence of *trust*. Trust might be defined as the feeling of confidence, believability, sincerity, among one's family, friends, business contacts, in the institutions of the society, in the System. Without some bare -good times with good minimum, life would be intolerable and social relations would not exist. One goal of a good society might well be "to expand

-feeling of absence of constraints, absence of compulsion; freedom to act, and freedom from being acted upon

Novelty

-encountering the untive

Dominance

-status of superiority to something or someone

Control

ponsibility of having control over events or over other people

-the "freedom" of not having to choose, the satisfaction of participation without responsibility.

Identity

-pride, satisfaction with self-image, personal dignity

Social Acceptance

or by peer group; prestige

Trust

Love -loving and being loved

Congeniality

friends; crowds at public events; companionship

the sphere of trust." Many other qualities of the desirable life might be placed in a similar category.

As soon as one admits survival is not an end in itself but a means to other ends, the question enters "what are those other ends?" Perhaps the most modest answer, and one that occurs frequently nowadays in policy talk, is "a good quality of life." What are its ingredients?

Dalkey, Lewis, and Snyder followed a sociological approach to compile, by opinion survey, a list of 38 terms characterizing a desirable "quality of life". Rescher, a philosopher, put together a list of "consensus happiness requisites", going on to identify those that were "socially actionable", that is, those that governments might attempt to provide or ensure, as opposed to those that seem intrinsically to belong to the domain of personal freedom and idiosyncracy. In this way he arrived at a set of *social* goals. For the moment, we shall try to stick to the private or individual level.

Neither Dalkey et al., nor Rescher, concerned himself with the material, physiological, or species needs, on the grounds that, in Dalkey's words "in the United States at least, these are generally taken care of at better than subsistence levels". A backward glance at the needs listed so far will suggest that the omission is not so easy to justify. Not only is a sharp boundary between type of need impossible to draw, but, for many Americans and Canadians the assumption of living at better than subsistence levels is still far from true. However, a more important point is that a remarkable proportion of the basic systems of our North American society have been created, and are still being created, to meet those very needs. Thus, to ignore the "physiological" needs could lead to some serious distortions of perspective regarding the purposes of our main social institutions, and consequently to distorted interpretations of what is commonly meant by social goals.

These authors might argue that they are justified, in that they are simply directing their attention to the question: assuming that survival is a means to other ends, what are those ends? But the discussion suggests that the question cannot be so simply posed. Each need, so long as it is deeply unsatisfied, tends to be regarded as an end, or a goal in itself; as it approaches some degree of satisfaction (always relative) it comes to be seen as a *means*, a prerequisite for moving on to something else.

One reason for our confusion over goals and values is that the average individual in our society *has* been progressing upward on his need-satisfaction or utility curves, even though the distribution of progress throughout the society has been inadequate and uneven. As he approaches the knee-point on some of these curves (the region where further degrees of satisfaction are less urgently desired) the marginal priorities among the various needs or goals can shift wildly, and new ones move to the centre of

Solitude

N. C. Dalkey, R. Lewis, D. Snyder, "Measurement & Analysis of the Quality of Life: with Exploratory Illustrations of Applications to Career & Transportative Choices", RAND Corp. RM-6228-DOT, August 1970.

Nicholas Rescher, "On Quality of Life & the Pursuit of Happiness", RAND Corp. P-4224, October 1969.

K. Baier, N. Rescher, Values & the Future. The Free Press, N.Y., 1969.

Meaningfulness

-sense of purpose or importance to life, particularly one's own life

Must a (woman's, man's) reach always exceed (his, her) grasp?

Material Well Being -affluence, the feeling of having enough attention. Lakoff puts it this way:

"Scientific society . . . makes its appearance when a mature industrial society is able to devote a substantial share of its resources to costly projects in science and technology which bear on the entire spectrum of social concerns, including industrial productivity, while extending to all other areas as well. The result is a considerable change in the focus of social energy and concern. The basic rationale of industrialization is the aim of overcoming the problem of scarcity and the need for physical labour. Once this fundamental aim is accomplished, resources, energies and talents are free to be applied in new directions. At this point a new rationale Sanford A. Lakoff, begins to be needed. Scientific society aims to eliminate not only the constraints of scarcity, but countless other constraints, both physical and moral, which have grown up in the course of history. This is the reason why the ideologies developed in the course of industrialization (and a fortiori the religions of a pre-industrial era) seem increasingly irrelevant and inadequate in the context of modern society. It is also the reason there is so much confusion over the allocation of scarce scientific resources and over the reconstruction of the social system, both domestic and international. To put it simply, industrialization focused attention on the goal of increasing material productivity. The rationale of scientific society is much more open-ended, diffuse and indeterminate: to use science and technology to remove as many as possible of the constraints upon human capacities."

Thus, as material needs begin to be satisfied, certain problems such as confusion and boredom arise, and hopes are raised that perhaps, finally, the satisfaction of all other desires is near at hand. People become less content to work away for the sake of eventual rewards in heaven or in a future earthly life. And as Maslow says:

"paradoxical though it may seem, need gratification is a determinant of need frustration. This is true because higher needs will not even appear in consciousness until lower, prepotent needs are gratified. And certainly, until they exist they cannot be frustrated. The merely surviving man will not worry much over the higher things of life, the study of geometry, the right to vote, the good name of his city, respect, worthiness; he is primarily concerned with more basic goods. It takes a certain amount of gratification of lower needs to elevate him to the point that he is civilized enough to feel frustrated about the larger personal, social, and intellectual issues."

Thus we should not be surprised to find, in the affluent society, a rising disenchantment with past goals and a thousand versions of what to do next. Certain elements, frustrated at not is assured. finding their own scale of values adopted, take an attitude, "if

Science & Policy Issues, edited by Paul J. Piccard, Peacock Publications, Illinois, 1969.

"What, after all, is boredom but overgratification? -Maslow, op. cit. p. 118.

Other-Worldly Reward

Hope

-that the future will bring better things

Sense of Progress

-the feeling that things are changing for the better

Faith

-the feeling that things will turn out alright, that things are going in accordance with plan, that you or the universe is being looked after by a greater power, that future reward

Gotterdammerung Tragic Drama, or Samson bringing down the Temple (or sometimes, just adolescent pique)

Back to Nature

-sense of man's primitive roots in the soil; aesthetically the feel of warm sunshine, blue sky, ocean breezes, unsullied wilderness

Beauty

-as opposed to ugliness

B. F. Skinner, Beyond Freedom and Dignity, Knopf, New York, 1971.

I can't have what I want you can't have what you want either", and they make it their goal to bring the whole System crashing down around their ears. The goals of some individuals imply social conflict.

If the pursuit of goals were entirely up to the individual, the question of priorities would not be a problem for policy. But the individual must enlist social relationships to pursue his goals. and as the interests of individuals interfere with each other, they must be compromised and adjudicated. An agreed set of needs and values would be a help. Indeed, some level of consensus is essential for a society to function, but comparison of the different listings referred to shows wide variation, at least in the authors' perceptions, but certainly in the society as well. Such comparisons help to warn us of the hypothetical status of Maslow's ordering, or any ordering like it, and the danger of building too much on the implied ordering of priorities that it conveys. Not only are people at many different stages of personal development, but they believe in different things. It is tempting to the scientific mind to assume that all religious and philosophical systems will ultimately converge to a single "true" theory of human nature, from which would follow a single natural scale of priorities. But even if that might be useful as a working hypothesis, its time for application is not yet. At present we have many philosophies, religions, ideologies, or sets of cultural beliefs, each one of which would claim to be the correct or "natural" one. Some create more harmonious societies, some more egalitarian societies, some more active, some more spiritual. From any criterion internal to science, their claims have to be judged equally valid.

The flaw in the idea of convergence may be even more fundamental. Even a "true" theory of human nature would likely preserve the idea of "freedom of the mind" (though there are more drastic cosmologies that do not) and therefore thinking, and behaving, in different ways would be a permanent feature of the human condition. A state where everyone held the same ideas, and cultural differences disappeared, would surely signal the end of the world – in an intellectual sense, an entropic death.

This does not mean that there cannot be large areas of practical agreement, but it does mean that a naïve adoption of the hypothesis of "scientific" convergence would probably not only be useless, but could be operationally dangerous; it conflicts with notions of humán free will, open-endedness of evolution, and could lead to policies of total social conditioning. The powerful operant conditioning principles demonstrated by the behavioral psychologist B. F. Skinner have always been present in our processes of socialization, but to employ them consciously, deliberately, and presumably more effectively, to shape behaviour toward someone's theory of what is ideal or desirable introduces hazards of a new dimension. *The application of social science is* subject to all the dangers of do-it-yourself surgery, and caution is a good policy.

To take up again an earlier point, we have to recognize that certain value assumptions regarding ultimate or "highest" goals Pursuit of Excellence either explicitly or implicitly underlie all these approaches. Dalkey, et al., try to avoid assumptions about values, by questioning Self-Knowledge people (Americans) about what they want. This has the weakness that it may give people credit for understanding themselves better than they usually do. Rescher tends to place happiness, and happiness requisites uppermost, though he does also discuss what seems to be an innate drive for the *pursuit of excellence*. Maslow in his earlier work seems to place self-actualization, and desire to understand, in some sense higher on the scale than material comforts, though he rarely mentions happiness as a human need or goal. In his later work he progresses to a more explicit stand:

"it looks as if there were a single ultimate value for mankind, a far goal toward which all men strive. This is called variously by different authors self-actualization, self-realization, integration, psychological health, individuation, autonomy, creativity, productivity, but they all agree that this amounts to realizing the potentialities of the person, that is to say, becoming fully human, everything that the person can become."

The trouble is that the person does not know this. He strives after intermediate values:

"So far as the person himself is concerned, all he knows is that he is desperate for love, and thinks he will be forever happy and content if he gets it. He does not know in advance that he will strive on *after* this gratification has come. and that gratification of one basic need opens consciousness to domination by another, "higher" need. So far as he is concerned, the absolute, ultimate value, synonymous with life itself, is whichever need in the hierarchy he is dominated by during a particular period. These basic needs or basic values therefore may be treated both as ends and as steps toward a single end-goal."

Thus several recent writers attempting to re-define the goals of mankind have placed self-development as the fundamental goal. Others place more stress on the human as a social being, and emphasize social organization, and high civilization, both as a condition for self-development and as an expression of it. Aristotle saw the ultimate purpose of social organization and —John David Garcia, sub-purposes such as efficient production, as freeing time for contemplation. A more recent writer, entering from a base of science, John David Garcia, questioned the values of Western civilization and placed himself alongside Teilhard de Chardin in postulating the evolution of consciousness, or "awareness" as the ultimate goal. He condemned the pursuit of happiness as Row, New York, 1959.

Happiness

Knowledge. Understanding

-the need for explanations, the need to know (the need that seeks satisfaction in science, philosophy, theology, mysticism, etc.)

A. H. Maslow, Toward a Psychology of Being Van Nostrand, New York, 1968, p. 153.

Evolution. Self-Development

Gerald Feinberg, The Prometheus Project. Mankind's Search for Long-Range Goals, Doubleday, New York, 1969.

The Moral Society, Julian Press, New York, 1971.

-Teilhard de Chardin, The Phenomenon of Man, Harper and

Awareness, Aliveness

Sensual Pleasure

Ecstasy -"feeling high"

I. K. Taimni, *The Science of Yoga*, Theosophical Publishing House, Wheaton, Ill., 1967.

A. Etzioni, "The Search for Political Meaning", *The Center Magazine*, March-April 1972.

Religious Feeling

-awe, cosmic sense, feeling of worship, oneness

Spiritual Serenity

-mental and emotional peace, state of grace, bliss equivalent to hedonism (and thus a diversion) and positively immoral. Philosophers have always questioned hedonism as a way of life, sometimes so effectively that people have become unable to experience pleasure without a feeling of guilt. Yet, is there anything that should be wrong with pleasure or enjoyment of life? What of the person who finds his or her main satisfaction or happiness in the pursuit of human development? And is the pursuit of spiritual bliss simply hedonism in another guise? One answer is as old as the *Vedas*. Enjoyment or pleasure (at any level) is only a proper appreciation of God's universe – provided one does not become attached to it or bound by it, that is, as long as it does not become an end in itself. Then progress is held back.

Etzioni has remarked that a "retreat to hedonism" is characteristic of societies whose traditional value structures are dissolving. He also sees it as a logical outcome of the progression from an economy of scarcity to one of abundance - from Calvinistic self-denying capitalism to a philosophy of high consumption. Hedonism, therefore, can be expected to be characteristic of present times. However, the indications are that these times cannot last – at least not in their present form of pursuing hedonism through high material consumption and at the cost of high environmental deterioration. And even if practical reasons did not stand in the way, even if a solution were sought through the "technological fix" (the electrical stimulation of pleasure centres in the brain would surely not consume much electrical energy nor have much impact on the environment) the philosophers might well turn out to be right - the aimless pursuit of pleasure, even of many varieties, will pall, and can be but a passing phase.

These ethical and axiological speculations give some warning of the treacherous ground on which we tread as soon as we make any attempt to identify broad goals or to establish hierarchies among these collections of basic human needs, particularly in a society in which homogeneity of religion or ideology either never existed or is dissolving. To what degree is social consensus possible – or necessary? The remaining parts of this study, it is hoped, will progress a little farther toward answers.

The problem of heterogeneity raises questions regarding the current tendency to make "quality of life" into a single concept or policy variable – one that it is hoped will be measured by a set of "social indicators". Unless treated very carefully the concept will turn out to be no more than a subterfuge, only a trick with words that for a while *seems* to avoid the problem. Each lifestyle will have a different definition for what constitutes the good life.

If there is indeed such a divergence, how are we to measure progress? One suggestion is that it may be easier to define a good quality of life by what it is *not* than by what it is. People

may not always agree on what they need to be happy, but they usually agree quite widely on what makes them unhappy. Another facet of this idea is illustrated if one makes an elementary attempt at a hypothetical model.

Suppose we wished to evaluate for an individual some quantity that we might call average happiness, or average satisfaction with the quality of life - it is not important that we specify exactly. This quantity would presumably be a composite of many ingredients, drawn from the spectrum of basic needs. If it were written as the summation of a long series of terms, perhaps dwindling in importance, then the first term in the series, the "zero-th order" term, might well refer to the material/physiological needs. It is often suggested that "happiness" can be measured by the ratio of what is available relative to the needs felt. The happiness quotient or ratio then could be increased either by producing (acquiring) a greater quantity and variety of things, or by persuading oneself one had few material needs. If the equation were written in the way described, a large first term could dominate the sum, indicating that with a high material prosperity we ought to be happy no matter what was the case with the other terms – a result that does not accord with reality. Suppose, instead, the equation were written with its terms the other way up. Then we would have a measure of dissatisfaction or unhappiness expressed as the sum of a series of terms. As each term was "satisfied" it would approach zero. Thus any single term could be responsible for a high level of dissatisfaction, and an average or lasting happiness (low unhappiness) could only be achieved by the simultaneous satisfaction of many needs. As a particular term, say material-goods dissatisfaction, was brought to a low value other dissatisfactions would arise to dominate the equation. Such a model structure would seem to correspond better to the concepts developed in the preceding paragraphs. A more technical approach in terms of marginal utility functions would reach similar conclusions.

Of course, we have no right to expect that something as complex as human motivation could be modelled as the linear addition of a series of arithmetic terms. A less elementary model would have to take account of fluctuations with time, in both the levels of dissatisfaction and the individual's awareness of them. The attention shifts from one need to another and, indeed, sometimes a transitory delight in some material acquisition does Suffering, Deprivation blot out all else. Further, it seems that peaks of happiness or unhappiness, of excitement or depression are more significant or important to the individual than longer periods, for example, of mild contentment or boredom. For one thing, they are remembered better. We do not understand how all of these factors and kinds of experience are put together into what could be called deprivation to some a good life. Still, the modelling experiment seems to suggest that, as far as average conditions are concerned, measurements or pleasure

-discounting masochism as a psychopathology, the point remains that polarities are essential to perception; without experiencing suffering or degree, we cannot appreciate well-being, or indicators based on levels of dissatisfaction may be inherently more useful for policy purposes than indicators based on positive levels of satisfaction.

Such a "negative indicator" approach may also be the most feasible for a society of diverse lifestyles. It implies a philosophy of minimum interference, of removing impediments, constraints, and dissatisfactions so far as socially manageable. It operates at the periphery and leaves the centre open. It tries to *free* human capabilities, but not to tell people what they should do. A minimum interference principle would use operant conditioning only where necessary to cure or prevent obvious social pathologies. By contrast, an approach based on *positive* indicators would tend to be based on positive social goals, and operant conditioning would tend to be used to condition people positively into acting to pursue those goals as their own. Thus positive social goals might be seen as interfering with human freedom, in a sense, by moving to fill the centre, rather than leaving it open.

Finally, a word about the use of "goal" in connection with the individual. It is clear that the reduction of any particular dissatisfaction can be made a goal, in fact any immediately felt need or drive can be construed as a goal, in a short-range sense. It may be more useful to restrict the use of "goal" to longerterm conceptualized situations, though we would have to admit that the all-consuming goal of the shivering skier over a particular period of time might be to get to the lodge for a hot cup of coffee. The most general definition of goal for our purposes may be a *particular (conceptualized) state of affairs that we desire* to bring about. A goal of an individual may then have many ingredients or it may have very few. An individual can have many goals. All will be related to or made up in some way, out of his or her needs, values, aspirations, drives, or fears.

Before moving on to social and national policy, it is as well to remember that the individual too has policy problems. He cannot simultaneously satisfy all his wants, his selfish desires conflict with his desires to cooperate and help others, and he constantly trades off his long-term goals and values for the satisfactions and certainties of the short term. He may not be consistent through his lifetime: what he campaigned for during his youth may amuse him when he is older. Further, his memberships are multiple. He shares in the goals of family, community, social group, professional group, corporation, province, nation, and thus at times he finds his loyalties pulling different ways.

III. Goals and Systems

To carry the investigation further it is essential to understand something about the various means or systems by which goals are pursued. A system-atic structure to society is imperative, otherwise the problems of organizing afresh for every trivial task would overwhelm us; it is only by reducing the satisfaction of some needs to routine that we can free our minds to move on to other, possibly "higher" goals. Once social systems have been set up, many goals can be sought and needs met without ever requiring government policy intervention (except in the weak sense of maintaining certain basic rights and rules of procedure). For instance, a boy who yearns for a ten-speed bicycle may find that he need not move heaven and government, but only stir the system enough to find himself a newspaper delivery route.

However, when a social system is not working as well as it might, its revision may present peculiar problems, precisely because it is a social rather than a mechanical system. Social systems are structures in which people find roles. Individuals identify their own interests with these roles and with the growth and/or stability of the system. To some extent they begin to warp the system to satisfy their own ends, and they identify and interpret their own limited goals in terms of the system in which they live. Thus the system begins to appear to have goals of its own. It acts as a sub-society within the society, and the innovation or modification that with a mechanical system would have been a simple case of mechanical re-design is resisted and turns into a social struggle and a conflict of goals. That is why no theory of social or governmental decision making can get very far without allowing for the special role and special characteristics of institutional, bureaucratic, or system-interested behaviour.

The systems in a society become more and more specifically articulated and institutionalized as the specialization of social role develops. In the modern democratic capitalistic industrialized state, the systems' structure is probably more complicated than most of us are aware of, and perhaps beyond analysis. The structural materials out of which social systems are built, and which give them a degree of permanence, have traditionally been authority-relationships, legal and other social conventions, environmental constraints, economic relationships, ideas, traditions, ideologies, human personalities, as well as investments in physical facilities, like roads and stone buildings. To the recognition of those tangible and intangible structural materials now must be added the recognition of an increasingly large component of technological interrelationships, investments in machinery, and knowledge.

Looking back at a primitive stage of social organization, we would see basic material needs being met by personal work, family or tribal sharing, and by barter. Private survival needs would probably rank high in the scale of priorities, but social collaboration as means would be in evidence very early. Shared

G. T. Allison, *Essence* of *Decision*, Little, Brown & Co., Boston, 1971. See especially Chapter 3, "Organizational Process".

Hunting, fishing, farming, weaving, tool-making concern for security, territorial defence, and administration of justice would lead to collective action and thus to the emergence of recognizable social goals. Organization to look after these would be accomplished through principles of fealty, which would entrust leadership to the head of family, tribe, or state, Welfare problems (such as care of the aged, the incapacitated, the orphaned) would be handled informally, through family, tribal, or feudal ties. For knowledge and wisdom one would look to the elders. The need for explanation would not be easy to satisfy in a widely mysterious world, and the "mysteries" would often become the province of a specialized group who were judged to have some sort of affinity with the gods – witch doctors, shamans, oracles, and priests.

At a later stage, we would see the original primitive functions becoming institutionalized into classes, castes, or "estates" the nobility (and military), the clergy, the merchants, etc. History records their contests for ascendancy, each drawing on its particular power base. Clearly exhibited has been the tendency of the individual to identify with the system in which he or she plays a main role, and to feel that as the system expands in social importance, so does he. Further, each institutionalized system tends to be controlled by an élite, sometimes for better, sometimes for worse. Inevitably the élite tend to exploit the system for their own goals. Often the human urge for power and status is prominent among these goals, and the system may become exploitative and repressive, tolerated by the masses only because they lack the power or the organization to overthrow it. Often the relationship is seen as a bargain or contract, participants in a system tacitly according higher rewards to the élite in return "Power tends to for their entrepreneurial efforts in organizing and expanding the system. (Though at some stage questions are bound to arise as to whether the rewards taken by the élite might be excessive, and might contain elements of the exploitative motivation; the argument may not be easy to resolve.) Occasionally, too, the élite may be motivated by a genuine altruism. In any case, the ties that bind people into social organizations soon become more complex than the primitive tribal fealty (which, if one could analyse it, would be complicated enough).

Today, we see in the Western world various versions of the J. K. Galbraith, The "corporate state" or government-industrial-financial complex. Yet, although interrelated, this complex is not monolithic. Power Boston, 1967. is distributed among a pluralism of corporate decision centres, including large "corporate" unions and, although these centres have similarities and share common interests, it is no longer accurate to speak in terms of a monolithic ruling class. The bases of power are multiple, and their weights are shifting with technological change. Giant multinational corporations negotiate with governments; small labour unions, for example, garbage collectors, bring modern cities to a halt; ubiquitous communications

corrupt . . ." -Lord Acton, 1887

New Industrial State, Houghton-Mifflin,
"The pen is mightier than the sword" – or is it only a writer's wishful thinking?

Are the Universities the Church in new guise?

systems link societies into "global villages" in which the voices of dissident minorities reverberate out of all proportion to their numbers. The structures of power reflect the beliefs and values of the time, and create structures to preserve and propagate those values. But ideas cannot be held static or confined indefinitely within ideological or institutional walls. When controlled by power interests, ideas and communication systems can be instruments of coercion, but sooner or later ideas mutate to become the inspiration of revolutions. The influence of technology, particularly communications technology, can be noted in the way that the traditional institutions, such as family, church, and school system, that formerly carried the task of passing on the values of the culture, are tending to be replaced in their influence by mass communication technologies, first of the printed word and now radio and television. Those in turn may be replaced by technologies that re-emphasize two-way interaction rather than mass broadcasting, and encourage the formation of new communities, perhaps in many dimensions besides the geographical. The rise of communications technology has shifted the balance of power to new élites and, just possibly, may bring a "yeastier", more flexible society in which the flux of ideas in public discourse will play a more determining role.

The original tight, self-contained, geographically-localized community still exists in many places, but generally it has given way to an entire matrix of communities or systems in many dimensions. An individual is a participant in many systems, only some of which can be located by geographical coordinates. To describe that situation, and thereby to understand it and perhaps see better where science and technology does it harm or can improve it, we need an appropriate language. The older traditions in humanities and social sciences spoke in terms of hierarchical authority-structures, classes, cliques, personal contests for power, institutions, organizations. The newer language, partially borrowed from the physical and biological sciences, speaks more in terms of systems, and it is that language which we shall find more useful. The word system, while it may seem less precise, allows for connotations of a more dynamic quality, and more varied forms of coupling and interaction, than can be conveyed by words like structure, and institution. Words suitable for dealing with houses and buildings, and stable aristocratic societies, do not work well in a universe of living organisms, mobile populations, electrical signals, information links, and democracies in flux.

One technique for delineating the general features of the present systems of our society would be simply to plunge in, beginning from the list of needs and goals in the second chapter, and identifying for each the system or systems through which it may be satisfied or pursued. What we would obtain would be an apparently chaotic mixture of many types, ranging from the Political System (with all the various levels of government),

A LIST OF BASIC SYSTEMS

The Political System

through the Economic Market System, the Law-Order-Justice The Economic Market System, the Educational System, many kinds of public utilities, and voluntary organizations. Or, beginning from the basic physiological needs, we might identify the Food System, as including the farms, the food processing and packaging plants, food factories, fertilizer plants, farm machinery, and the food transportation, distribution, and retailing network. More recent thinking might include the processing and recycling of waste, to make it more nearly a closed system. Similarly, the Clothing System would extend from sheep farmers, cotton fields, synthetic-fibre The Educational factories, through textile mills to clothing designers, garment factories, and retail stores. The Shelter System would include land developers, planners, contractors, building-materials industry, real-estate dealers, do-it-yourself homeowners. What it all would show is that the universe of human transactions can be analysed or sliced into systems in numbers of different ways.

Since the conventional categories of political science and economics often fail to present the dynamic qualities of societal interrelationships (for example the technological and informational interrelationships which are the very features of most interest to science policy), we shall use a different point of departure. Consider the viewpoint of the ecologist. As Dansereau says, "the re-reading of history, sociology, economics, anthropology, and even theology in an ecological perspective may well promise a more objective approach to human affairs."

The ecologist finds it useful to organize observations of the versity of Montreal, interrelationships among living things in terms of trophic levels, or feeding relationships. Thus, more or less within the biosphere, he or she may identify minerotrophy (transformation of rocks into soil by action of air, water, etc.), phytotrophy (plants feeding on minerals), and zootrophy (herbivores feeding on plants, and carnivores feeding on herbivores). Dansereau generalizes the concept to two more levels - investment (accumulation, storage, and reinvestment of resources for the benefit of the members of that trophic level), and noötrophy (control and organization). Each level or sphere interpenetrates and interacts with the others to a degree. For example, other animals besides man extract information from their environment (noötrophy) and change their behaviour accordingly, with resulting impacts on other levels, even on the distribution of minerals. From this perspective the ecologist may be led to use phrases such as "predatory capitalism" while at the same time may regard such behaviour as only consistent with the total scheme of things.

A related version pictures the geosphere as surrounded by concentric spheres named the biosphere, the technosphere, the Michel Batisse, "Ensociosphere, and the noösphere. These "spheres" coincide in space, but stand one "outside" another as different system levels, letin of the Atomic on a scale of content of "intelligence", or on a basis of different Scientists, modes of interaction.

System -Food, Clothing, Shelter, general purpose "consumer" needs

The Law-Order-Justice System

The Banking System

System

Welfare

Health Care

Recreation

Pierre Dansereau, "Dimensions of Environmental Quality", Sarracenia, no. 14, Institut d'Urbanisme, Uni-May 1971, p. 38.

vironmental Problems and the Scientist", Bul-February 1973, pp. 15 - 21.

Thus, the *biosphere* "describes the film of life which surrounds the entire earth, with all its ecological interactions and all the things which make life possible".

The *technosphere* "is a higher level of organization, which has become important only recently. . . This is not only made up of the factories, the dams and the irrigated fields, but also the whole canvas of technological facts and features of a physical, chemical or biological nature. . . ."

The sociosphere "is the level of organization of human society . . . [It] includes the institutions [such as governments], the legal systems, the economic patterns, the professional structures, the military groups. . . ."

"Finally comes the sphere of ideas, of knowledge, of the mind, which we can call the *noösphere*. This is the highest level of organization, dominated by the cerebral cortex of *homo* sapiens, from which flow civilization, culture and the sociosphere. This includes the minds of the scientists, of the engineers, and of the philosophers. . . ."

It would be attributing a false precision to these schemes, and to our own analysis, to attempt to follow one or other of them exactly. It will be enough to extract from them the general concept of many dimensions of systems, interacting through different modes, and standing in a hierarchy of levels. As we review more of the system features of our society the difficulty of and, indeed, the self-deception implicit in a neat classification scheme will become plain. Because of that, the review list of basic systems in Figure III.1 will be left as a mixed collection with no attempt at a consistent ordering.

In Canada most of the basic needs for food, shelter, clothing are supplied through the market system, with policy controls acting mostly from a higher, or meta-level, in the form of adjustment of the money supply, interest rates, taxes and tariffs, antimonopoly legislation, standards. Thus it may be convenient to lump many such items together under the heading, the Economic Market System. We should do this only if we remain aware, however, of the dangers of succumbing to popular myths, forgetting the many ways in which the market mechanism has been found to be imperfect and has had to be corrected by more direct interventions, (e.g., by farm subsidies, marketing boards, government corporations, minimum wage legislation and wage and price controls). We should keep in mind what we may be obscuring; there would be valid reasons, particularly from the viewpoint of science policy, for differentiating, for example, agriculture, non-renewable resources, petrochemicals, or energy; often, looking at industry as a productive technological system, the "free enterprise" habit of drawing sharp distinctions on the basis of ownership or management being "public" or "private" could be almost irrelevant.

In principle, all of the systems could be said to be part of or



-for "organizes" read sometimes "feeds on"

-for "is reacted on by" read sometimes "is constrained by"

to be controlled through the political system. In practice, how- "Too often the asever, as we know, many of the systems are semi-autonomous administrations or institutions and respond directly to choices or influences from the individual private citizen, singly or in aggre- ship between the gate, whether through the market mechanism or otherwise. In fact, in view of the total complexity of the society, and the known limitations of bureaucracy, a decentralization of policy control this 'democratic' imaginto a plurality of more or less self-regulating or self-governing subsystems is not only advisable but a pragmatic necessity. The competitive market is one among these self-regulating mechan- to shape decision-makisms that has had a fair amount of success.

Clearly, a degree of autonomy or autarchy among subsystems is desirable, but what degree is the optimum? Autonomy exacts its price. Institutions tend to go their own way, and self- icies and Goals, Heath, regulation breaks down if the regulating circuit is incomplete, poorly designed, or if the "market" the system supposedly serves

sumption is made that the only question at issue is the relationpeople and their elected representatives; too complete a focus on ery may preclude recognition that there are other forces at work ing.

-edited by K. M. Dolbeare and M. I. Edelman, Institutions, Pol-Toronto, 1973.

"While more powerful vis-à-vis the people than it has been in living memory, the government governs less than it did when it was weaker. The paradox is the result of the decomposition of governmental power from within and without: through the feudalism of semiautonomous executive departments and through the feudalism of the concentrations of private power."

—Hans Morgenthau, "The Public-Private Complex," in *The Political Order*, Basic Books, New York, 1970.

National Defence

Public Utilities -fire protection -water supply and drainage -waste disposal -electricity

Urban Design

Environmental Protection

Public Health Protection

Communication

(the concept of technologies as biological species, in competitive evolution and in ecological interdependence)

The Transportation System

Scientific Research

 research f o r n e w knowledge, funded by a mixture of public and private support, linked into one system by scientific communication comes to be dominated or controlled by a special group – perhaps those having a vested interest in the system itself. Certain educationists may design their systems after their own image of what the students should be like, (i.e., people who will turn into professors, and expand the system), and turn away the others. The profits-and-market-prices system does not adequately selfregulate when the prices do not include real costs, many hidden or external costs being sloughed off into other systems, e.g., the costs of pollution, waste disposal, traffic congestion, occupational diseases, even the costs of inefficient employees. (In the North American private enterprise system, inefficient or handicapped or temporarily surplus employees are often turned out, and left to be picked up by the welfare system or employed by governments.)

Most of the systems named are not monolithic but multiple. Communication, for example, includes many modes, such as telephone, telegraph, television, teletype, radio, broad-band digital for computers, facsimile, newspapers, magazines, letters, etc., not to mention face-to-face conversation. Also, the categories are mixed in terms of conventional distinctions between "public" and "private" sectors. The Economic Market System responds directly to private consumer purchases, but also supplies collective needs, or public goods and services, purchased on the collective behalf by governments, i.e., through the Political System. Some natural monopolies, such as water supply, and electric power, which obviously do not lend themselves to regulation by market competition have been moved from the private enterprise domain either to public ownership or to close public regulation. Nevertheless, they can be sensitive to consumer demand, with little political intervention. On occasion, they find themselves competing with alternative modes offered through the private market sector, for example electricity competes with coal and oil (still in the private sector in some countries) for some types of energy use, and public transportation systems compete with the private automobile and bicycle. In fact, there are advantages to having a certain redundancy of systems. Besides providing a resilience in the face of emergencies, redundancy is the basis for an evolutionary adaptability as other aspects of the society change. Though the many species of technologies are designed by man, they exhibit some of the characteristic features of Darwinian evolution and natural ecology.

The existence of these redundancies and multiple modes poses problems for classification and one may well doubt whether it is meaningful to speak of "the Transportation System", for example, when a single basic need is served by several competing modes, or by a combination of public transportation, and private vehicles moving through public space and on public roads. A possible criterion for speaking of a single system might be the emergence of, or the recognition of the need for, an overall policy, for example, an overall transportation policy.

The recognition of these functions or systems, as systems, is a continuing evolutionary process. It is only recently that the safeguarding or preservation of the environment has emerged as a defined policy issue, and so we begin to speak of the derstanding or control Environment as one of the systems serving our needs. If not all of the headings in the margin have yet been articulated into discernible systems in Canada, they should at least be recognizable as being in transition. Consumer protection - a network of services for information, research and testing of products, to assist the average consumer in making intelligent choices – is an increasingly urgent need as the products become more technologically sophisticated and as the consumer's wants are pyschologically manipulated to the seller's advantage. The massive dren, Human Ecology, scientific and technical resources that some large industrial corporations can bring to bear on the design and marketing of their products need to be counterbalanced by other types of research and publicity on the consumer side for a proper assessment. Consumer Protection We can expect such a system to grow rapidly, indeed we already see it taking shape in a number of forms besides the government testing laboratories (voluntary consumers' associations, and "Action" columns in newspapers).

It must be accepted as rather arbitrary how many systems or subsystems are left as parts of the general economic system, or political system, or whatever, and how many are distinguishable. It is not obvious where to stop, and to some extent the choice of categories or system names is arbitrary, corresponding to different ways of slicing the same universe of atomic transactions. However, the incidental problems of defining boundaries and choosing sets of categories are not so serious as to invalidate the basic concept, any more than we would say it is meaningless to speak of tall buildings when, depending on circumstances, "tall" might mean 50, 500, or 5000 feet.

Any resemblance of this list to a list of contemporary government departments and agencies is more than coincidental. In fact, the measure of evolution of a modern democratic state might be taken to be the degree to which it has specifically articulated its structure to correspond to the perceived individual and social needs. The role of the government with respect to each system may differ, but the creation of a specific agency or department in the government is usually a clear recognition of the system and of its need for policy.

The list bears also an observable affinity to the list of "goal areas" prepared by the Economic Council of Canada in its Eighth Annual Review, in connection with a discussion of Social Indicators. There the starting point was different, but the end result, view, Ottawa, 1971. and the intent, is similar. In the terms used in this study, the Social Indicators or Goal Output Indicators developed by the Economic Council would measure the performance of the various need-satisfying or goal-realizing systems. In the Economic Coun-

"Yet in the last third of the twentieth century, man still cannot claim either full unof the environmental systems that support his growing population. This is the central truth of the manenvironment relation today: man is still part of nature, not master of it."

-P. E. Ehrlich, A. H. Ehrlich, and J. P. Hol-Freeman, San Francisco, 1973.

Culture and the Arts -mixed modes of private and public support

Religious System

-once the State Religion, now generally divided among private churches and institutions, but still subsidized; guardian of the long-term values.

Economic Council of Canada, Design for Decision - Making, Eighth Annual Recil's chart, the goal areas are displayed in three general categories, tending to suggest that they are realizable through three types of system, Political, Social, and Economic. Although the Economic Council makes a special point of emphasizing the *interrelationships* between these categories, such a classification still may overly encourage the tendency among the public at large to believe that most of their concerns can be conveniently lumped together and disposed of under a heading called "the economic system." To guard against such over-simplification, let us take some space to review "the economic system" from the point of view of an economist.

Robert A. Solo sees four types of economic systems simultaneously operating in the Western-type democracy. First is the Decentralized Market-Directed Form. This is the classical competitive free enterprise system, of consumer choices in the market place, of small entrepreneurs in high competition, of widely dispersed market power. Economic allocations are the result of a large number of independent choices. Under the double spur of profits and competition, the entrepreneur minimizes costs for a given output, and the consumer benefits. The government role is to interfere as little as possible, except for certain regulation, prevention of monopoly, and maintenance of the legal and monetary infrastructure. Because of its decentralization of choice, with the individual reaping the benefits from individual decision, the small-scale free enterprise system has been outstandingly successful in maintaining a high level of entrepreneurial motivation. Yet, because of that dispersal of decision, many costs and benefits external to the individual self-interested transaction are not taken into account. The "double spur of profits and competition" is strong incentive to externalize costs as much as one can get away with. Over the two hundred years since Adam Smith we have generally believed that the net balance of social benefits over costs has been positive, but in recent years and under the prodding of E.J. Mishan and others we have begun to wonder whether the balance might not have turned. A "logic of small decisions" leads the individual motorist to add his little bit to the smog-ridden city; the difference his one exhaust pipe makes seems an insignificant penalty compared to the inconvenience to him of going another way. Consider analogous situations for commerce, add the "logic of competition", and there is the basis for industrial pollution of air and water, the fishing out of whales, the exhaustion of minerals, the inflation of urban land-values, the displacement of people by office buildings, the rising levels of urban noise - the tragedies of competition.

Second in Solo's list is the Centralized Politically Directed Form of economic organization. In this system economic activity results, not from private purchases and the shifting prices of a free market situation, but from the action of government imple-

Robert A. Solo, Economic Organizations and Social Systems, Bobbs - Merrill, New York, 1966.

E. J. Mishan, The Costs of Economic Growth, Staples Press, London, 1967.

menting a plan or program decided on as a matter of social policy. In some countries, this form encompasses almost the entire economy. In Canada, the scope of the public sector has A. Schonfield, Modbeen more limited. However, as in other Western countries, the amount of government involvement in the economy has been Public and growing, for various reasons, some of which will become clearer Power, Oxford Unias we proceed. In a sense a democratic government acts as a broker to obtain for the people what they desire or prevent what they do not desire. The policy or plan may be the development of a region, the implementation of a complete system for health care, the development and construction of a high speed ground transportation system, the improvement of cities, the cleaning up of a watershed, the development of a defence system, the landing of men on the moon, and so on. The government acts to please a "market" of voters, but has a variety of resources, including legislative and coercive power, that it can use to bring its plans into effect. Whether sufficient incentives act to ensure efficient use of financial resources is a concern often expressed. Perhaps the most important incentive is that the number of worthwhile and even urgent goals always seems to exceed the resources available. There is an internal "market" of programs competing for the available funds. The manoeuvring of entrenched bureaucra- H. Seidman, Politics, cies to favour their internal goals is a serious impediment and has Position, and Power, to be countered by constant vigilance and special techniques to Press. New York, keep the primary goals uppermost.

Third, is the Semi-Autonomous Organizational Market-Negotiated Form. This is the sector of big business or large corporate enterprise, now such a strongly characteristic feature of Western economies. In Solo's words,

"decision-making is neither by individuals acting independently nor by the collectivity acting through its instruments of political choice. Rather, action is organized primarily through autonomous organization. The key agencies of economic control are voluntary associations, profitoriented, countervailing and countervailed against, negotiating together and existing in a context of negotiated relationships. Goods and services are produced and are offered for sale, but the market is not master. Activities are not controlled by a free-moving price. Rather price is decided as a matter of policy, or is agreed upon by counter-balancing powers."

"Production is organized by large corporations in which thousands of individuals in varying capacities associate voluntarily for purposes of mutual gain. That part of labour which is not highly specialized or managerial negotiates its working conditions and wages through trade unions."

"Consumption of end products is partly by decentralized individual choice and partly through collectivized choice of government."

ern Capitalism: The Changing Balance of Private versity Press, London, 1965.

Oxford University 1970.

"The market is not the mastering mechanism. It is a forum for negotiations, a showcase for display, an area for manoeuvre by entities that find their analogue in rival nations. The struggle of each to survive, to maintain position, to grow, and to "win" is real and of many dimensions, but rarely does competition erupt in the mutual catastrophe of "price war". Price does not automatically reflect resource availability and end-product demand, but signifies rather corporation or trade union policy, or a negotiated relationship between autonomous powers. It cannot be assumed that price is an index of real scarcity. Nevertheless, as a determinant of costs, price guides the planning of purchases, inputs, and consumption."

The private consumer is still independent, but not entirely sovereign, since his or her choice is bounded by the prices that are set and by the products that are offered. Large-scale advertising by the corporations is able to shape tastes and demands over a considerable range.

The role of government is as both "coparticipant and mediator." It acts as an influential consumer by "articulating on the market those social values which cannot be expressed adequately by the decentralized choices of individual consumers" and it undertakes to influence or regulate the policies of the autonomous organization.

"It may do this by acting directly on the determinants of organizational planning, for example, through tariffs or subsidies, through changes in the pattern of taxation, through monetary measures intended to alter the rate of interest or through fiscal measures intended to affect consumer demand. Or, the government may regulate organizational policies by legal directive or influence organizational policy by moral suasion."

The government may also attempt to influence corporate policy by incentives to R & D, hoping thus to encourage innovation and growth, or to influence multinational corporations in their policies regarding location of subsidiaries, product responsibilities, and freedom to export.

The Semi-Autonomous Organizational Form presents important problems, particularly for Canadian policy, because it encompasses most cases of foreign ownership, or international and multinational corporations. Since the largest capital resources of these autonomous entities, their decision-making power, their research, and their corporate policies, are centred outside Canada, the negotiations undertaken by Canadian government, or governments, as "senior sovereign among sovereignties" must often take on the character of negotiations with foreign powers.

Finally, Solo's fourth category is the Institutional Economy. This, too, ostensibly exists to provide what people want but through more or less autonomous institutions, such as charitable

- "Corporations are, in large measure: 1. the object of nation-
- al goals; 2. the formulators of
- national goals; and 3. the executors or
- 3. the executors or achievers of national goals."

-Charles Williams, National and Corporate Goals", Bulletin, Institute of Management Sciences, June 1971. foundations, churches, schools, cooperative associations, and so on. They do not operate under the market system, nor are they agencies of government. They do, in a sense, compete for the individual's dollar and for the tax dollar; nevertheless they often tend to take on a life of their own, with their own internal values. The university educational system and the community of basic research are two such systems, closely interwoven. They are supported in the main by public funds but, as a matter of policy, they are given considerable autonomy. It is conceivable that at times their internally-generated values and goals lead them to diverge from the best interests of the public at large, or from the best interests even of the narrower public they exist to serve.

To a political scientist, the systems of the society would look different again. Political science, or "politics," studies the processes by which social actions are agreed upon, the processes by which authority and power are concentrated and legitimated, and the processes of competition and negotiation among powers. Thus, there is considerable overlap with the economic point of view, but the scope is broader. In principle, all processes by which one or more persons influence the behaviour of others can be considered under the heading of politics. Sometimes, as a matter of academic politesse, the political scientist and the economist may regard their spheres as distinct but, when it comes down to dealing with the real world, the political scientist cannot help but see bureaucracies, institutions like universities, and business corporations, as political systems - and often political sys- "When one considers tems of a particularly authoritarian kind. In fact, if one were to judge the importance of a system to an individual according to the proportion of time and attention he or she spends in it, behaviour of the socione might often validly observe that many a supposed free citizen of a democracy actually spends more of his activities under dictatorial political regimes.

The picture of the total working system revealed by this review is a complex one, with a plurality of subsystems through which citizens, singly and collectively, press toward their goals. But a pure pluralism or an absolute individualism would be unworkable. Somehow coordination must be brought about, and conflicts must be resolved. Yet, the linkages between systems are many and varied; they do not fall neatly into classifications like "economic", "political", "social" or "technological". One senses that the conventional language is beginning to approach its limits for dealing with the universe of social systems. Some new concepts may be helpful.

The language of cybernetic systems is most appropriate to talk about national our purposes, and is making rapid inroads into economic and social theory. "Cybernetic", from a Greek word for helmsman, was introduced thirty years ago by Norbert Wiener of MIT to describe a class of mechanical or electrical systems designed to "guide" or "control" in accordance with designed-in charac- op. cit.

national policies and national goals, he must think about the total ety which is the stream of many individual decisions made throughout a very pluralistic set of diverse institutions. Collectively, the actions become our operating national policv. In that context, single decisionno maker, not even the [head of state], makes national policy. All decision-makers in large organizations make policies that are national in scope. This is an important distinction. It is impossible t goals independent of corporate goals, or to talk about corporate goals independent of national goals."

-Charles Williams.

teristics and in response to information from the environment. When programmed for certain targets, such systems exhibit a "behaviour" very analogous to many biological "goal-seeking" systems with which we are familiar. For example, a mechanical robot can be programmed to identify and pursue a certain kind of "prey", or to maintain a certain condition automatically, e.g., a constant temperature, in spite of ambient effects. More advanced types can be designed to be self-repairing, or to pursue a goal of self-preservation, or even to "learn" from the environment by trial and error, remembering the successful responses and incorporating those patterns into its programming. The concept of cybernetic or "feedback" system is discussed further in Appendix A. The similarity of many of these response patterns to behavioural responses of living organisms has led to the increasing use of such systems as conceptual models to unravel and explain biological systems.

The extension of such models to humans and to human systems must proceed with care, however. A common error is to allow the heuristically-useful causal mode of explanation to run away with itself, until the element of human free choice in the system has been "explained away" or forgotten about. When dealing with human social systems this philosophical pitfall must be avoided. The key is to distinguish between the fact that much human behaviour is predictable to a degree, at least in a statistical sense, and the assumption that all human behaviour is causally determined by history and circumstances. The success of our modelling may lead us to suspect that human behaviour is determined far more by history and environmental influences than we might prefer to think. Nevertheless it is inadmissible to design social or political systems on any assumption other than that humans do act, and are entitled to act on free and unpredictable choice.

Jay W. Forrester, "Churches at the Transition between Growth and World Equilibrium", Zygon, vol. 7, no. 3, pp. 145 - 167.

The techniques developed by Forrester for modelling social systems on computers are particularly flexible. Almost any behaviour pattern of decision makers that can be described in words can be written into the model, including the stated goals and values of key actors, (e.g., statements such as "my goal is to increase sales", or "if so-and-so happened I would probably do this", or "whatever happened I would never kill a fellow human being".) In this way a great number of interrelationships known to human observation can be built into the computer model and the result is a computer-assisted dynamic mental model of the social system of greater complexity than can be dealt with in any single human brain. Frequently the systems model exhibits responses over time that are surprising or counter-intuitive to the unassisted single intellect, yet they duplicate and thus suggest an explanation for a previously puzzling perversity of the real social system. Sometimes the modeller is able to show that the real actor has been following exactly the wrong policy to achieve

the objective he v is trying to reach. These features are described in Forrester's words in Appendix B. The Forrester-type models have encountered heavy criticism from some quarters, much of it based on misconceptions of what the modellers are claiming to do. It is true that the modelling proceeds in general as if all interactions are causally determined, and it is true that people find it easy to slip into the error of forgetting that the causal assumption is only a useful procedural rule and, at best, no more than probabilistically true. But these aberrations are not essential to the technique and should not be allowed to vitiate its usefulness. For example, one approach, and perhaps the one most used up to now, could be termed a hybrid: some subsystems are modelled in the deterministic mode, while leaving some decision points open for free, unpredictable, or arbitrary inputs. A more sophisticated development, and one that would help to guard against misinterpretations of the output, would be to build into the model the probabilistic character of the assumed interrelationships. One would then find that, as the time variable ran the program into the future, the built-in uncertainties would propagate through the model and the output would appear more and more fuzzy, diffuse and undetermined - the apparent precision of prediction would dissipate into the mists of future time. Whether the uncertainties built into the model would then be regarded as expressing the ineluctable incompleteness of information, or an intrinsic free component in human behaviour, might not matter for most practical purposes. (The quantum physicists, for example, got around a similar philosophical problem by concluding there was no way to decide and, in any case, for all practical purposes there was no need to decide.) However, when it comes down to the question of designing or re-designing social systems, for example, politics, and education, the point remains that maintaining the philosophical distinction is likely to be crucial.

Stafford Beer approaches the design of social systems as a cyberneticist trying to enhance the effectiveness of (free) decision Stafford Beer, The makers. Thus he is concerned mainly with the flows of information and control by which various levels of systems interact. Because human decision makers are limited in the amount of Penguin, information they can deal with, that is to say, they saturate under too great a rate of information or too great a number of variables, control must be distributed through the subsystems, and the higher orders of control and coordination must be achieved by transmitting only appropriate filtered or abstracted information between systems and from lower-order to higher-order systems. Similarly, it is not practical for higher-order systems to exert detailed control over the lower-order systems. Thus Beer is led to introduce the terminology of meta-systems, with their meta-goals, which are explained at greater length in Appendix C.

We have noted that the differentiation of the society into systems is a feature of social evolution. But this does not mean

Brain of the Firm the managerial cybernetics of organization, London, 1972.

"Because they are more capital-intensive, current decisions are longer-term in their effect. Once we have laid a modern road, it is a determinant for a longer period of the pattern of travel than would have been the case with a horse trail ..."

-Charles Williams, op. cit.

"If planning is homologous with organization, then plans – which of their very nature ought to be syntheses of parts into a great whole – become instead ever more detailed and localized sets of unrelated minor decisions." —Stafford Beer. "The

Liberty Machine", Futures, December 1971, p. 344.

"Federal organization everywhere in the world, is delineated by function. Thus it is easy to talk about the health of the people, about the education of the people, and about the social security of the people. But there are no convenient means for discussing the integral state of a citizen, who ought after all to be healthy and educated and secure - especially since each one of these desiderata probably depends upon the other two."

-Ibid. p. 342.

Thomas C. Schelling, "On The Ecology of Micromotives," *T h e Public Interest*, Fall, 1971. that it is good in all respects. Departmentalization, institutionalization, bureaucratic structuring can be regarded as forms of ossification. They slow down further evolution, tend to make a system less adaptable. The capital-intensive nature of modern technology accentuates the tendency.

People acquire vested interests in a system, they find security in it, they learn how to operate within it to their own advantage, and the system itself gets locked in by its relationships with other systems. Innovation becomes more difficult, because the system interprets the future within the confines of its own history. Overall policy and planning become more difficult, because an organization or department tends to plan only for itself. Thus, the structuring designed to break the social activities down into manageable pieces, and to delegate the decision making, has the disadvantage that it leaves the holistic view behind. Planning and policy lose themselves in detail and forget the interactions.

To break out of these restricting and narrowing effects of formalized and "vertical" organization, new forms of boundarycrossing, holistic, and "horizontal" organizations are necessary and are in fact beginning to appear, some under private auspices, some governmental. Interprovincial committees of resource ministers, of environment, of economic affairs meet to integrate government policies across provincial boundaries. At the federal level, new "ministries of state", for science and technology, and for urban affairs, have been created to bring back a more integral policy view, and a freedom to innovate outside the departmental mind-sets. Quasi-independent interdisciplinary policy study groups, such as the Science Council, the Economic Council, and the Institute for Research on Public Policy, have been created by the federal government to *think* holistically, nationally, critically, and innovatively, as an antidote to the day-to-day short-range and compartmented point of view. These organizations may be thought of as the institutionalization of a function for which the need was formerly felt only sporadically, and which was satisfied by the appointment of transient and ad hoc Royal Commissions or task forces. These are only beginnings, however, and perhaps only a transient phase in the evolution of far-reaching new social structures.

Pollution has awakened people on a large scale to the policy problems that the society has to solve consequent on individuals, and systems, pursuing their private goals and planning for themselves alone. Yet pollution is only one of many problems of related type that result from the pursuit of "micromotives," without regard to their macro- or long-term effects. The "tragedy of the commons" takes many forms. Thus the social effects, the external costs, the mutual interferences or incompatibilities of self-interested transactions have to be regulated and harmonized by meta-systems. Meta-systems, many though not all of which are governments, have to achieve meta-policies which are broader

in scope and longer in time range than the narrow short-range planning of particular self-interested individuals, sub-systems, and systems. National goals are more than the aggregate of individual goals.

Even so, national goals are not imposed from above, out of "the failure of metathe blue, as it were. They are arrived at politically. The federal government, as the highest-level meta-system of the Canadian society, is responsible for formulating, articulating, negotiating, or crystallizing a particular kind of meta-goal appropriate to its level of working. Being more responsible than other institutions for overseeing and coordinating the social organism as a whole, the federal government is also responsible for operating and improving the systems machinery by which those goals are expressed, that is, the political process. A goal of the society as a whole persumably is to improve all its systems machinery. This implies both improving the sensitivity or awareness of the whole organism to the demands arising within it, and improving the capability of the systems to deliver.

We have tried to bring out in this chapter the "interactingsystems" character of our society, emphasizing the multiple intersecting dimensions in which systems can be defined, and the complex modes through which they interact. In the context of goals, systems are intermediate between individuals and the total society; they tend to exhibit goals of their own, which may conflict both with the goals of many individuals and with goals identifiable as those of the society as a whole. They are generally supportive of the public welfare, else they would not continue to exist, but their record is not free from problems or adverse effects. They organize and add power to individual motives, and in doing so may amplify and institutionalize some of the faults of individual decision making, such as excessive self-interest, and concern with the short term. The formalities of organization may retard evolution and may de-personalize some of the relationships that formerly mediated and harmonized interests at the individual or small-group level. Further, the dynamics of collective or corporate decision making can in some ways exaggerate and intensify problems of the type associated with the "pursuit of micromotives." (Consider the management of a business corporation, constrained from enlightened social policy by the singleminded pressure from the shareholders for dividends.) To restore the balance toward the publc interest, the rights of individuals, and the holistic and long-term view, various forms of governance, or guidance by meta-systems toward meta-goals are required. These notions will be enlarged upon in the succeeding chapters.

systems in society is due to their conception as higher authorities which cannot conceivably exert that authority in a free society."

-Beer, op. cit., p. 345.

IV. Goals, Meta-systems and Governments

When the subject of goals is raised in connection with governments, the phrase "national goals" usually comes to mind. Unfortunately, the paradigm that tends to come with it is all too often that of the concerted national effort characteristic of a nation at war. The war paradigm has an appealing simplicity. All the problems of diversity and conflict of individual, group, and system goals fade into the background as all goals are subordinated to and aligned with the overriding national goal of survival. The picture is like that of Magnetism, where all the higgledy-piggledy little bar magnets representing the random magnetic domains line themselves up with the overriding field of the big external magnet. Unfortunately, like so many other wartime institutions, the paradigm serves us poorly in peacetime. We must develop concepts of government, and national or societal goals, that are more realistic and, regrettably, more complicated.

Practically every human being in the world today is subject to government. To many, the government seems imposed, even oppressive, and is put up with only because the alternatives, such as social chaos, personal imprisonment, loss of livelihood, or even the hardship of the sustained personal effort that would be needed to bring about change, appear as less desirable alternatives. By others, the government is looked on as a creation of themselves or their ancestors and, while not perfect, serves them reasonably and can be expected to improve. In either case, and from either perspective, whether the government is inherited as the creature of power groups who created it to serve their own interests, or whether the government was "democratically" created by the mass of the citizenry – whether government is regarded as master, or servant – the point we need here is that if a government did not exist it would have to be created.

By this I do not mean to say that a corrupt or oppressive government, no matter how bad, is better than no government. Bad governments should be thrown out. But they have to be replaced with better governments, not with *no* government. In a perfect world, some would argue, the perfect form of rule would be no rule at all – the ideal anarchy. In a less than perfect world, however, governments are *needed*. We shall try to build on the concept of the *meta-system*, as developed in the previous chapter, as an ideal form of government, existing because certain functions are needed by the systems and subsystems, which cannot be accomplished from within those systems. (Even the libertarian political theorists who have offered the most articulate and convincing arguments against centralized authority have recognized the need for some form of wider coordination of collective decision making and action.)

In one respect governments might be said to exist or be created as a matter of convenience, as part of the general specialization of role in the developed society. For example, as organized systems get set up they require management, and government becomes a handy repository for the management function of some of the systems, particularly those for which a market mechanism of control is unworkable. Recognizing their limited capacities, the citizens gain freedom for other pursuits by delegating functions to government. Ideally at least, the government is held responsible to the users, and is expected to operate, trouble-shoot, modify, and improve each system in the most efficient way possible. However, the need for government goes deeper than the convenience of particular systems management (much of which could be handled in other ways) and it is those other reasons for government with which we shall be more concerned.

It is not enough to operate each system in accordance with its own internal criteria of efficiency. One reason is found in spillover effects, third-party effects, or externalities. Plenty of examples of the spillover of costs, or disbenefits, from private or limited system transactions into other systems or into the public realm can be found in the fields of pollution, automobile traffic, public health, and so on. (In fact, so far, these effects seem to be increasing with technological progress and urbanization.) Spillover of positive benefits is a different story, and is generally welcomed by the public (except for those cases, like church bells on a Sunday morning, when there may be disagreement as to what is a public benefit and what is a public nuisance). The trouble with positive spillovers more often lies in getting people together to pay for enough of them. Industrial firms, for example, tend to under-fund research because they see themselves paying all the costs, while the benefits spill over to their competitors almost as much as to themselves. There are countless social situations of this type, where a meta-system is needed to integrate the externalized costs and benefits, in some cases feeding them back so that the original actions will be more rationally considered, in some cases paying for distributed costs or benefits out of general taxes, and in some cases prohibiting certain kinds of impacts outright by legislation.

In another example, a meta-system is needed to promote or safeguard some desirable general condition or value of the society that tends to be overlooked and perhaps squeezed out of existence if only narrow system goals operate. This can be illustrated by the example of *diversity*.

Social diversity can be taken as both a value in itself and as a political fact. But its preservation is not automatic. Various pressures act that tend to squeeze it out of existence. Bureaucracies everywhere like to simplify and rigidify systems to suit their own administrative convenience. Economic and technological forces press for the advantages of standardization and large scale. In the market, while the forces of competitive free enterprise often act to create variety and widen choice, they also often act to stamp it out – there is a natural gravitation toward oligopolies and monopolies. Against all these, and in spite of the fact that government itself would find it easier to deal with a homogeneous populace, government has the duty to safeguard, cater to, and even encourage diversity of choice, opportunity, and expression in the society.

Diversity can be catered to by providing for choice within the system, as the consumer market does - provided the government intervenes now and then to regulate malpractices, encourage small business, and enforce anti-trust legislation. Other systems may provide a service or a product that is non-specific, as an energy utility does by providing electricity without regard for how it shall be used. In other cases the problem is met by allowing for or ensuring the existence of alternative systems. An example of the latter is the public school system. It is generally possible in Canada for a parent to arrange for private instruction for a child, through the market place, if he or she decides that the local public school system is wrongly conceived. To what extent there is, or will continue to be, a genuine choice as the use of capital-intensive interconnected technology such as television networks, and computer-aided instruction, grows in public school systems is a question worth asking, however. It is questions such as how the technological possibilites can be exploited, while at the same time enhancing rather than diminishing diversity, that are the business of science policy.

The role of government becomes complicated by working at more than one system level. Working only at the systems operating level among other competing systems the government might forget its "higher" duty, to protect the public against the government itself as monopoliser. We might note here the warning that it could be a mistake to get into the habit of thinking of *the* government too simply, as unitary and monolithic, as a *single* meta-system.

Another thing for which meta-systems are needed is overall and long-range planning. We have evidence enough all around us that we invite disaster if we simply assume that the best outcome will follow automatically from innumerable self-interested short-range decisions. It is not enough for a government simply to respond to and integrate the pressures from all the subsystems. A logic of small minimum-energy decisions is the logic of the river-bed; it can just as easily lead to the swamp of social disaster. The holistic and long-range view that is the responsibility of the meta-system implies more than temporizing and compromise. This in turn implies restraints on the behaviour of the subsystems and individuals. Yet somehow, in a democratic society, the process of arriving at the meta-policies and the planning must be symbiotic, involving both systems and meta-system. After all, even when well done, the restraints planning necessarily imposes will appear to some individuals as irksome, to say nothing of how

"We did not intend to do this, but this is what we did." —Maurice Strong, United Nations Conference on the Environment, Stockholm, June 1972. they appear when they emanate from insulated bureaucracies or power cliques.

But perhaps, as some would argue, these problems are largely ones of insufficiently-enlightened self-interest on the part of the various systems and the individuals who comprise them. Certainly the pursuit of self-interest as we see it today does not always lead to the general good, but it might be argued that this is simply a product of narrow and ill-informed perception of self-interest, and that if individuals and groups were more aware of the likely effects of their actions the pursuit of the enlightened self-interest would be social and cooperative, that is, compatible with the common good. In that case, a higher authority to establish and enforce rules would not be needed as much as strategies for the dissemination of information to individuals.

There is not much doubt that the quality of society is enhanced to the extent that its individuals and groups act wisely on their own accord, without coercion by higher authority. However, there are at least four good reasons why this idealistic solution is not sufficient in itself for the modern world. First is a matter of historical context: it is probably impossible, or at least can be expected to take a very long time, to nurture new generations to have the appropriate abilities and inclinations to act cooperatively, when most of the institutions among which they grow up have an authoritarian cast. Second, even a fully enlightened, freely cooperative society would have use for common rules and conventions (traffic lights at busy intersections, for example). Third, such a society would imply that each individual was aware of and concerned about every impact of his or her actions on everyone else. Even if every individual were so motivated, the span of the mind is finite and at some point he or she has to hand over concerns to other individuals and systems. Finally, such a society would depend on a universally understood and agreed upon theory of the society, a shared world-view and a shared set of values, none of which are characteristic of our present world. Thus, while it is a pleasant diversion to contemplate the simplicity and harmony of an ideal world of perfect people, we must now get back to the business of practical politics.

The need for socially-agreed rules can be seen particularly clearly in certain cases, like the grazing of sheep on the public Garrett, Hardin, "The common, where each herdsman gains by increasing his own use of the common land. The logic of the situation is such that the simple pursuit of self-interest leads inexorably to ruin for all. Hardin has elucidated the structure of these situations and has applied his analysis to contemporary problems of conservation, Garrett Hardin, Expollution of the environment, and overpopulation. No single individual sees it to his advantage to behave in a way that would prevent the tragedy – unless everyone else can be made to behave Beagle, Viking Press, the same way. It might be said to be enlightened self-interest that New York, 1972. leads the individuals finally to form a compact to abide by rules -

Tragedy of the Commons", Science, vol. 162, 13 December 1968, pp. 1243 – 1248.

ploring New Ethics for Survival: The Voyage of the Spaceship rules, say, not to hunt the whales at a greater rate than so many per year. But the point is that rules are found necessary, as are means for enforcing them.

Another view of how individuals may be brought to modify their behaviour is that they may come to see, or may be induced to see what the *meta-game* is. As long as they conceive what they and the other players are doing as a simple competitive game in which each is pursuing his or her direct self-interest, the result will be inevitable (and often second-best, even for the "winner"). But if all the players can be "enlightened" to perceive that there is a meta-game going on, they may see that in fact the best outcome they can hope for is only to be achieved by negotiating certain agreements – in effect, by the creation of a meta-system. In some cases, we may hope, the meta-system could be entirely in the mind, that is to say it might be that simply the changed perception would be enough to change the nature of the game – the players would change their behaviour "spontaneously".

Schelling pursues this "micromotives" question into a wider range of situations. In one type, a decision needs to be made or an action taken in the collective interest, yet nothing in the situation designates one particular person to act rather than another, and indeed the person who does act may lose by it. Schelling gives the example of a mattress which has fallen off a truck onto the autoroute, unbeknownst to the driver. Who will stop to move it out of the way? The point of these situations is that good intentions, even altruism, are not enough. There must be organization, and initiatives and authority must be delegated to a public service agency or government. Perhaps it is that altruism, though it exists, is in short supply and to depend on it would overburden that small minority of the population. For most of us, perhaps what we do in effect is to *delegate our altruism*, so that we can go about our business of the pursuit of short-term self-interest.

Thus, to be better off, everyone in the society must accept some restriction, through the delegation of decision making, and through agreement as to rules. It amounts to a principle of legitimate, or *legitimated coercion*, legitimated through the political process by which the agreement is reached or by which the government is validated.

Furthermore, the coercion may have to extend beyond the parties to the original agreement. This seems straightforward enough in the case of a group of property owners on a stream. The majority, let us suppose, see clearly that it is in their common interest and in every individual's long-term self-interest to have a higher authority to arrange and enforce an agreement not to pollute the shared body of water. They see also that it is in their interest to keep the agreement and it would be anti-social to break it. A few deviants, however, may have different values and may see it to their own advantage to exploit the situation, enjoying the clean water, yet not bothering about the pollution

Nigel Howard, Paradoxes of Rationality: Theory of Metagames and Political Behaviour, MIT Press, Cambridge, 1971.

Thomas C. Schelling "The Ecology of Micromotives", *The Public Interest*, 25, Fall 1971, pp. 59 – 98. regulations themselves. Such behaviour can undermine the selfrestraint of the others and can cause the whole arrangement to break down. Coercion of such deviants seems clearly justified.

In many cases the answers are not so obvious, however, In a particularly short-sighted community, it might be those who advocate a non-pollution agreement who are the deviant few. Can coercion against them be justified? We are faced with the dilemma that action based on the majority opinion or prevailing attitudes, and action in the true common interest may not coincide.

If we take it that the responsibility of government is to act in the true common interest, how is that "true common interest" to be determined? If it is not to be found in the majority vote, is it to be found in the judgements of experts, or of wise men? Who is to tell the experts from the frauds? Who is to know the wise men from the fools?

If we take the seemingly expedient view that the coercive forces should be directed against those who deviate from the social norms or prevailing popular attitudes, we are still in difficulty for another reason. We have to have some means of identifying those social norms. In effect this means finding a way of aggregating the beliefs, preferences, judgements and opinions of individuals into comprehensible and coherent positions. Sometimes this is a simple matter but more generally there are profound difficulties. The preferences and opinions may be internally inconsistent and, even more serious, there may be no satisfactory Kenneth J. Arrow Socalculus for aggregating them or for balancing one off against cial Choice and Indianother. The now classic study by Arrow concluded, "Empirically we can reject the idea that the consensus can be found in the Haven, expressed individual wills."

These are not trumped-up difficulties, but serious problems that beset the foundations of the theory of democratic government, and are central to the question of how individual human goals get transformed into or are related to the goals of governments. These questions are probed in greater depth in a book by Settle.

It might be thought, since several democratic governments in the world have lasted quite a long time without violent revolution, that the democratic process must be reasonably well understood, at least at the practical level. This does not seem to be the case, however, if one is to judge from the volume of writings on the subject, and from the recurring questioning of national goals. It would seem that technological change, and social progress, have been changing the ground rules.

The element of coercion, for instance, takes on new dimensions as powerful technologies of weaponry, surveillance, information, and psychological persuasion become available to governments. Even large technological systems in general impress some people as but another manifestation of overrule of their

vidual Values, Yale University Press, New Connecticut, 1951, p. 64.

Tom Settle, In Search of a Third Way, Mc-Clelland and Stewart, Toronto, 1976.

values by the majority – a kind of dictatorship by majority. The movement away from the relatively dispersed loosely-knit agrarian mode of living into the tightly-interdependent technologically-advanced society entails giving up some freedoms. Some freedoms are gained, too, else technological progress would not be so much sought after. But what are the terms of the trade? And who determines them? The efficiencies of technological organization bring their own imperatives, and those imperatives make "technology" appear to some as a monolithic, bureaucratic, and impersonal machine. To the majority, undoubtedly the trade (a Faustian bargain?) appears advantageous. But to the dissident minority too much is being bargained away on their behalf. What should be the government's goal? Or, to put it another way, what should be the function of the meta-system? It would seem that one reason a meta-system is needed is to see that the alternatives are kept alive. Perhaps the majority-rule principle needs constant re-examination, case by case. In the field of radio and television programming, for instance, the Canadian Broadcasting Corporation has seen as its duty to resist pitching every program to the mass interest, a duty which the marketing-oriented networks can resist only with the greatest difficulty. Particularly interesting cases would be found in transportation technologies - comparing elements of freedom, service to minorities, infringement on rights of others - in comparing private automobile systems against public transport.

The democratic process, we should like to believe, improves along with technological progress. But there is no guarantee of such an outcome, without making it an explicit meta-system goal - that democracy should become more democratic. In former times (and still to quite an extent today) governments contented themselves with arbitrating among the strong, i.e., the special-interest groups, the corporations, unions, etc. So evolved the concept of pluralism. The well-organized groups could look after themselves fairly well, and negotiate among themselves, with a minimum of interference from government. The next step then was to recognize, consonant with a belief in the dignity of the individual, that government owed a special concern to the weak and unorganized, who would otherwise be ignored and trampled upon. Government may act paternalistically, in response to the diffuse voter pressure, to defend the "little man" against the power of organized systems, or it may create agencies to assist him to participate in the political process, on the pluralistic model. Major impediments to participation are the inability of many people to articulate their needs, to form in groups large enough to draw attention, to obtain the information they need, to hire professional services, and to know the entry points or the pressure points in the political system. Naturally the entrance of new previously inarticulate constituencies onto the scene is likely to be regarded by the established interest groups as a threat, even subversive to a degree, but it is the outcome society should expect as it raises the average level of education of its citizens.

Perhaps the major impediment to effective participation on which science and technology impinge directly is the problem of accurate information. Surely, true information (as against the distortions of verbal persuasion) is an essential ingredient for the functioning of a society that allows for a wide range of individual choices and that depends on those choices being to a large measure rational. And it is especially important that the weakly-organized and disadvantaged have at least as great an opportunity to know the facts and to have at least as complete freedom from distortions as the more advantaged and better organized members of the society. Traditionally, democracies have assumed that the only requirement was a free market place of ideas, fed by a free press, and common sense would find its way to the truth. Electronic communications and the growth of knowledge have changed the game. The "information explosion" now saturates the individual with more messages than can be assimilated. Under such conditions, true communication may actually decline, true and important information being submerged in the spurious and trivial. Are puffery and distortion becoming indulgences we cannot afford? Are new forms of anti-pollution regulation needed in the communications realm?

The possibility arises that the long-continuing debate over a free or a controlled press may be entering new ground - a free freedom of the press press is open to special-interest pleading, and commercial com- for the person who petition leads to sensationalism and the deliberate exaggeration of news. On the other hand, control by government may insert political or institutional bias, and stifle news for the sake of stability. It is possible that the balance of the arguments is shifting - either that, or some radically new system is needed. After all, the key to effective symbiosis of systems and metasystem is efficient two-way flow of information. The main fault in the systems in general use is the absence of demand feedback. The consumer is saturated with unasked for information, he has to sort through the whole mess for himself, and if he comes across an item about which he wants to know more, he tends to leave his desire unsatisfied, because the alternative is a tortuous and time-consuming process. The professionals in government and business positions often have fairly effective resources for information retrieval, but, until similar resources are available to the ordinary citizen, the power in the hands of the establishment experts will grow relative to the general public, and democracy will diminish. One can foresee the development of a rapid-accesson-demand information system as a kind of public utility, perhaps growing out of the public library system, with links into the universities.

Lakoff, for one, has characterized the "scientific society" as a society heavily dependent on and concerned with the

owns one

Symposium on Science and Democracy, Chicago, 27 December 1970, Sanford A. Lakoff, "The Political Theory of Scientific Society", American Association for the Advancement of Science, Annual Meeting.

Sanford A. Lakoff, "Knowledge, Power, and Democratic Theory", Annals American Academy of Political and Social Science, March 1970, pp. 4-12.

Do all meta-systems control by the same mode?

generation and use of knowledge - a "post-industrial state" as contrasted with earlier societies that were preoccupied with agriculture or industrialization. "A democratic system in which knowledge is made the focus of continuing public concern," he concludes, "is the only basis, under modern conditions, for government which is both effective and responsible." If citizens are indeed to participate and interact with meta-system decision making, rather than growing more and more alienated from a technocracy, then they must have access to the relevant information and knowledge. All too often, voluntary public groups questioning the wisdom of government and industry decisions have been denied access to the information upon which the decision makers claimed to have based their choices. The knowledge of scientists and other experts must be both available to and and contributed to public debate, not kept hidden within elite channels to power. The Science Council of Canada, we might note here, considers its main role to be working toward that end.

Not all meta-systems are governments. The Science Council is an example of a quasi-autonomous body, *created* by the federal government, it is true, but charged with taking a long-range and holistic view of science and technology in the Canadian society, critical of government if necessary, looking across political jurisdictions as appropriate, but keeping a national focus. Still more independent of government are the various professional scientific associations, voluntary citizens' associations, and the universities as a knowledge system. There is some difficulty in maintaining a clean distinction between "meta-systems" and systems that overlap or slice across other systems, particularly when discussing systems whose only mode of control or authority over other systems is the "authority" of knowledge or information. However, this fuzziness of definition should not prove to be a serious impediment for the purposes of this study.

Unfortunately, or sometimes fortunately, improved communication with the electorate can have an inhibiting effect on government, rather than making decision making easier. Without communication, it is easy to assume consensus when in fact none exists. Consensus is more likely, and might more reasonably be taken for granted, under conditions of relative homogeneity of beliefs, and wide agreement on basic needs. Such conditions can hardly be said to be very evident in Canada today. As the ability of the social organism to meet basic material needs has improved, the way has been opened for the more explicit emergence of a wider spectrum of goals, values, ideologies, life-styles, or whatever. Regional diversity shows a tendency to re-assert itself, in direct conflict with the homogenizing forces of economic integration, technology, and communications. Concurrently, as it becomes more highly organized, and urbanized, our technologically-developing society senses increasing cross-impacts of one activity on another, and feels a need for tighter self-regulation and planning - a greater involvement of government. The sense of shared space, of shared benefits and costs, tends to lead to demands for greater emphasis on public goods, as opposed to private.

Governments at all levels, trying to respond to demands for more intervention and tending to continue in patterns of action based on expectations of consensus, find themselves on a collision course with the emerging diversity. Governments can continue to get themselves elected, by assembling a package of policies, variously designed to appeal specially to one minority or another. Once elected, however, to act on this disparate collection of limited consensi may be something else again.

What are the appropriate strategies for democratic governments? When public opinion demands action in many contradictory directions at the same time, government is "damned if it does and damned if it doesn't." A typical response is to drift and dither but that, too, amounts to a course of action because other forces do continue to act – events continue with steady pace to plot a path toward outcomes that no one may want.

Perhaps we can identify some of the pragmatic strategies democratic societies have developed in attempting to cope with these difficulties. First, they operate with a central consensus so far as it can be elicited. Second, to take care at least partially of the dissident fringe, the minority groups, and the spheres where values are widely diverse, they move from the periphery, so to speak, with the principle of minimum human rights. Third, they use a "mechanistic" approach of setting up systems through which individuals and groups can pursue their own goals, the "goal" of meta-systems then being to service and improve those systems and mitigate their conflicts. A fourth approach is to mediate and facilitate the negotiation of trade-offs, whereby one faction allows another faction to gain some benefits, provided the first faction can obtain some other benefits that it prefers instead. These approaches by no means solve all the difficulties, and this will be brought out more clearly in the next chapter, which deals in more detail with decision making and politics. In particular, it has been emphasized already that the metasystems in many ways have to go beyond, to act more *responsibly*, than merely responding to pressures. To do so, they must have in mind some general principles, values, or goals.

Thus there is no escape. There must be a set of national (and regional, and municipal, etc.) goals and values by which governments can operate and which they can agree on as criteria for decisions. What can goals and values look like at such a level of generality, while allowing for wide diversity at the level of the individual? In that sense all the foregoing has been simply a preamble to dealing with the main question. We have tried to review what meta-systems (including governments) are *for*. We have reviewed individual goals, and have indicated something of the way they are pursued through systems, and the way that

systems need governance by meta-systems. We now must identify what these goals, or "meta-goals" of the meta-systems look like the so-called national or societal goals.

As a provisional hypothesis, we shall claim here that a relatively short list of these societal or national goals can be identified, at least for democracies in the Western tradition, that the same items turn up in most attempts to list national goals (several lists are exhibited in Appendix D), and that the main problems for governments arise (a) in trying to arbitrate the priorities and resolve the contradictions among these goals and values, and (b) in deciding on matters of practical means. The "goals for governments" are not listed in any deeply considered order of importance. Most of them have been foreshadowed in the preceding discussion.

1. Self-Preservation, National Sovereignty

National sovereignty, national identity, or the preservation of the nation as a nation is a necessary condition for a government to govern, and for a society to create conditions peculiar to the desires of its own citizens. The system for national defence follows from this goal. So do some economic policies and systems for the maintenance of stability and internal order. (A much narrower system survival goal, which may work for or against this general goal, is the goal of a particular political party to keep itself in office or to get into office.)

The appeal of self-preservation, or health of the whole, is so basic that more resources have probably been expended in the course of history, with fewer questions asked, on the basis of "We are witnessing a threat to national sovereignty than on any other justification.

Yet, commenting on the present, it might be appropriate to note that the idea of national identity is not so simple as it used of its members, a to be. Canadians are very aware that the emergence of Ouebec from an agrarian and industrial-age economy to an educated and knowledge-conscious society has brought a surge of self-awareness and cultural identity that, in the minds of some of its citizens, transcends any feeling of identity with Canada as a whole. Not only these elements, but also weapons technology and consequent changes in world politics, change the nature of the threats to sovereignty. The growth of communications technology, continentwide and world-wide, has reduced the degree to which an individual's interests and allegiances are geography-limited. The growth of world-wide commercial networks, such as those brought about by multinational corporations, may build mutualities of interest that, while undermining national sovereignties, may among other effects reduce the likelihood of wars. People now have many levels of allegiance, they belong to many communities of interest, many of them transcending national boundaries. The concepts of national identity and national sovereignty tend to become "porous."

Watergate

fundamental change in the structures of societv and in the outlook change that marks the end of a social order whose basic tenents were formulated in the nineteenth century. Already signs of a new order of civilization are increasingly evident."

"То--Léon Dion. wards a Self-Determined Consciousness". Quebec Society and Politics. edited bv Dale Thompson, Mc-Clelland and Stewart, Toronto, 1973, p. 26.

2. Human Development

A widely-held human goal, often asserted to be the ultimate human goal, is the development of each human being to the limit of his or her capacities. The corresponding goal of social The desire to rest policy, taking account of the wide variation in stages of development among members of the society, and the different directions people choose for development, tends to take the form of providing opportunities and removing constraints. Thus government plays an *enabling* role, as designer, manager, and trouble-shooter of the basic systems.

This goal, therefore, includes many of the familiar subsidiary or intermediate goals associated with social development. It includes, for example, the usual conditions for a well-functioning economic system - rising incomes, stable value of money, full employment. It also includes the establishment and improvement of educational systems, health care and physical fitness facilities, public utilities, and the building of theatres, concert halls and cathedrals. In fact, it includes most of the systems listed in the previous chapter. As the society develops technologically and economically, it becomes capable of meeting its basic material needs with less of its total human effort, thus increasingly freeing its citizens, on the average, to develop in various directions of their choosing. The demands for expansion of this or that system shift, and government revises its spending priorities accordingly, often singling out the improvement of a specific system as a current working goal. New facilities, even new social systems may have to be designed if human development is to continue in desired directions. The current effort to develop Social Indicators amounts, in many respects, to an effort to develop performance indicators for these various existing systems. Whether present criticisms of the conventional indicators for performance of the economic system are a consequence of the process of economic growth itself - where we find ourselves stifling in our own external costs - or a consequence of profit motivation, the pricing system, or the transition from an industrial economy largely occupied with production of durables to a technological-scientific economy trading predominantly in "services" is beside our present concern, except to note that conventional statements, even of economic goals, can no longer be taken for granted.

3. Freedom and Human Rights

It is not easy to think of a single title for this category. "Optimization of Freedom" is possible. It is intended to identify one particular function governments are called upon to fulfill - that of regulating the mutual interference of humans on each other's freedoms. The exercise of free choice by one person in a social situation diminishes in some measure the freedom of others, as a general rule (though some situations can be identified where the interaction is synergistic). In consequence, many forms of proto-

where one is, to enjoy being, might be included as a special case.

Optimum individual development may be achieved through optimum nutrition. optimum health, provision of challenges demanding effort, and growth in an atmosphere of love."

-Bentley Glass, "The Goals of Human Society", editorial in Bio-Science, March 1972.

col and social contract are found necessary. Many of the situations described by Hardin and Schelling are cases in point. One time-honoured technique for dealing with these inherently difficult arbitrations is to try to define for the individual a set of minimum rights. The right of safe passage on a street is one, the right to privacy of abode is another. Many of these rights are enshrined in our legal codes, civil and criminal. The concept of citizens' "amenity rights", as Mishan argues, is the soundest basis from which to take action against polluters of the environment. A similar case, not yet well recognized, is the problem of safeguarding the long-term quality (health) of the human species, which individual consumers and manufacturers are wont to trade away in favour of short-term interest and gain.

4. The Just Society

A goal modern democratic governments hold high is to strive to make the social systems work so as to assure equal opportunity, fair reward, just punishment (justice in coercion), absence of discrimination or favouritism, and equitable distribution of the benefits of collaborative endeavour. Although this goal is often reflected in legislation and enforced through court process, it is a broader principle than, for example, providing minimum levels of police protection against physical violence or even the defining of minimum rights.

5. Democratic Process: Participation

The political process deserves particular attention, though the concept of participation can be interpreted more broadly than applying simply to a citizen's influence on the formalized political machinery itself. Not only do individuals like to feel they play some part in the political (government) process, but they like to feel they participate in some measure in all the decisions that determine their future. Thus the improvement of "participation" (and the reduction of "alienation") may imply also the development of new "democratic" decision-making structures in large business corporations, universities, and other institutions. The roundabout process through government may be felt to be too indirect, slow, and total-consensus-dependent for the world of electronic communications and ideological diversity.

6. Stability and Progress

These two contradictory conditions are set side by side because the usual goal of governments is to steer a middle course, or walk a chalk line, between a stable society, which may be easier to manage and in which people feel secure, and a progressive, growing, and innovating society in which institutions are constantly breaking down but in which people feel a sense of hope that things are changing for the better. Alternatively, stability and progress could be two separate goals, recognizing that most items

The rights of the yet unborn.

in any such list compete or conflict to some degree (e.g., national identity and diversity).

7. Diversity

The preservation and encouragement of diversity as a goal can be derived from a concept of basic human nature, in which sense it might be regarded as implicit in goals 2 and 3, but it can also and independently find a basis in evolutionary ecology. Monocultures and highly specialized systems are highly vulnerable. They can suffer drastic fluctuations, sometimes total collapse or extinction. To ensure a modicum of stability, and survival through changing conditions and new challenges, the socioeconomic-technological eco-system needs to contain a wide and balanced diversity. The system as a whole continues to evolve and adapt, because it contains within it suitable forms that can grow to meet new needs. Thus some tendencies toward a oneworld culture, one-world economic system should probably be resisted.

8. The Holistic View (a. The Environment, b. The Future)

A responsibility that surely resides in the meta-system is that of seeing the systems and their interactions as a whole. Thus concern for the environment is a natural responsibility of governments, as is the accounting and governing of the external costs and benefits, or spillovers, generated by particular systems pursuing their separate goals. Governments pick up the social costs of technological change, of the casualties of competition, and of resource depletion. They also fund education, and basic research, because private interests would tend to fund less than the amount optimum for the general benefit. In another dimension this responsibility takes the form of the long-range view of planning for the future.

It seems to be asking a lot of governments, under the present political style, to think further ahead than the next election, yet, under the heading of carrying out a social contract in the citizens' own best interest, somebody must plan ahead, impose policies for the conservation and generation of scarce resources, and all of that sort of thing. Where else should such a function logically reside, but at the level of the meta-system? Democraticallyelected governments have not solved the problems arising from the four or five year electoral cycle, and solutions are still being to have available to all sought. The existence of a Senate of life appointees might in principle provide an element of the needed continuity, though so research and thinking far in its history the Canadian Senate has acted more as guardian can be carried out into of continuity with the past than as anticipator of the future or guardian of foresight. To some extent long-range planning in specific systems is accomplished by creating special government Speechfrom the departments, agencies, or Crown corporations. Another approach being tried is to invest responsibility for long-term policy advice September 1968.

"... it would be useful governments an institute where long-term governmental matters of all kinds."

-Governor General's Throne 28th Parliament, 1st Session, 12 in certain public institutions outside the political structure, (the Science Council, the Economic Council, the Institute for Research on Public Policy). (The analogous holistic Council for the Environment, recommended by the Science Council in its Report No. 9, *This Land is Their Land*..., has not yet been created, as of the time of writing.) These structures will be discussed at greater length in the next chapter. However, we note "the holistic view" as an increasingly recognized goal or responsibility of meta-systems in the society.

Comment

It would not be difficult to add more to the list. Even so, the headings given encompass fairly well such goals as are listed by the Science Council in Reports No. 4 and 9, by President Eisenhower's Committee on National Goals, by the U.S. Department of Health, Education and Welfare in its document, Toward a Social Report, and by Rescher in his study concerned with "socially actionable consensus happiness requisites." These lists, given in Appendix D, are more notable for their similarities than their differences. For comparison a completely independent but not unrelated list is added, Sir Kenneth Clarke's summary of the values of Civilization. What we are concerned with so far is the taxonomy or typology of goals, particularly those that are called "national" goals. The next step, the process of selecting and ordering a particular set of goals to be given priority, and the relation of that set to policies for science and technology, will be discussed in the next chapter.

A propos of Rescher's use of the words "happiness requisites", it might be noted that the word "happiness" in connection with goals has not occurred before in this chapter. When "pursuit of happiness" is so often spoken of as a human goal, and when so many politicians speak of their goal as being "to keep people happy", how so? The truth, as Rescher himself says, is that happiness is beyond the power of governments to provide. The best that governments can do is to help set up the conditions under which human beings can develop their "capacities to be happy" and that role can be subsumed under the various headings listed. One could go farther and assert that a government policy of opportunistically pandering to people's short-range desires for pleasure and entertainment (keep them happy at all costs) would be a betraval of responsibility (i.e., its contract is to safeguard the "real public interest"). Garcia puts it more strongly, asserting that the pursuit of happiness (hedonism) is an immoral "copout" from the true human evolutionary purpose, which is development. Most religious traditions, on the other hand, promise some kind of spiritual bliss or happiness at the end of the road. (Though the sterner schools avoid the contradiction by rejecting conduct based on the expectation of that reward as being in itself immoral and likely to disqualify the candidate.)

John David Garcia, The Moral Society: a rational alternative to death, Julian Press, New York, 1971. At present, perhaps as an aspect of increasingly widespread hedonistic attitudes in our society, we have a spate of religious movements that promise almost immediate bliss. Is chemicallyinduced bliss happiness? This diversion has the point of illustrating that the word "happiness" is so entangled with deep philosophical issues that, as far as possible, it may be best to avoid its use altogether as an explicit goal for public policy.

V. Goals, Priorities and Politics

In this chapter, we undertake to follow the individual and social goals into the political processes by which they become embodied in the actual decisions and programs of governments. We particularly want to know how the priority choices are affected by, and have effect on, scientific and technological developments. In other words, how does Science Policy come about?

There was a time when this analysis might have been thought a trivial and peripheral exercise. Even with respect to the total activities of government in all spheres, the attitude of the prime movers of private enterprise would have been "just stay out of the way as much as you can and let us get on with the job." In the particular sphere of science, a few decades later, research scientists would have said, "just keep up a steady (growing) supply of grants so that we can do our work, and that will be your Science Policy."

All that has changed, though the old paradigms continue to be widely held. In the economy generally, the expenditures by the public sector, that is to say the expenditures controlled through the political system rather than through individual and corporate decisions in the market, are no longer a minor or peripheral perturbation. The proportion in Canada, steeply rising in recent years, now exceeds 45 per cent of the Gross National Expenditure, and will likely exceed 50 per cent within the decade. The phenomenon, although less pronounced in most other countries, is world-wide and reflects the levels of economic, technological, and social development of a country, as well as such factors as a more crowded interdependent world, a trend away from a private exploitive toward a social welfare ethic, and a trend toward the service sector and public goods, as primary physical needs are met in greater measure. However, we do not wish to debate the merits of one management or allocation system over another, but only to remind ourselves that the resources now handled by governments are extremely large. To be sure, some proportion of the money flow can be categorized as transfer expenditures, having to do with the redistribution of income (pensions, welfare payments, subsidies) as distinguished from outright operating expenses and purchases, but transfer payments amount to not much more than 20 per cent of the total at the present time. In sum, the amounts that flow in routes determined by political decisions (at all levels of government) in Canada add up to tens of billions of dollars (\$41.8 billion in 1971). Federal expenditures directly related to scientific and technological research and development exceeded one billion dollars for the fiscal year 1973-74.

Faced with a management problem of such magnitude, how does government cope? The system becomes too unwieldy to be handled by the old practices of personal judgment, and accommodation among a small élite. Modern governments search for *techniques*, in the hope that more of the decision making can be

"As private consumption grows, because of the interactions among parts of the economic system, it is probably necessary that the social infrastructure grow even more rapidly . . ."

-Science, Growth and Society, Organization for Economic Cooperation and Development, Paris, 1971. rendered methodical, objective, rational, and "scientific," reduc- Analytical Methods in ing the dependence on guesswork, intuition, emotion, impulse, and special interest. So it is that words like "cost-benefit analysis" and "planned-program-budgeting" have been seized upon as answers to a Treasury Board's prayers, long before they could offer an operational reality to back up their first fine promise. This attitude has been particularly characteristic of the field of research and development, both because of the desire of people associated with that field to think "scientifically", and because the results and the costs are so intangible and unpredictable as to seem to cry out for some better method – some administratively more processable method, rather than simply a research director's judgment. Besides, to the extent that evaluation remains the esoteric province of a few experts, it becomes much more difficult for the general social goals to have influence, as against the selfinterests and possibly the self-delusions of the few.

However, before getting entangled too deeply in the jungle of decision-making techniques, it will be useful to sketch the esty's Stationery Office, general features of the system in which they are applied. Analytical techniques, and organizational structures, after all, are simply tools used to improve the functioning of basic political processes by which individual preferences are translated into social decisions. It is all too easy to gravitate to the neater problems "Consequently: he who of administrative decision making and forget the complexities and the "messiness" of the political reality.

The naïve approach is to think of a government as a single monolithic entity, behaving as a single human individual would. A more sophisticated analysis, however, recognizes that while it is true that all decisions are made by individual human beings, a government is made up of many individuals who interact and negotiate with each other in complex ways, complicated by the diversity of their goals and by their linkages into systems.

At the "micro" level the basic process, as McKean sees it, is a weighing of costs and benefits, or "utilities." Each individual weighs the costs and benefits to himself of a given course of action. If it is to hold as an explanation of real behaviour, the concept of costs and benefits must be broad enough to include, for example, the psychic costs to the person of public disapproval or of acting against some value or moral principle he or she may hold dear.

"Each person - whether acting as a member of a household, as a businessman, or as a government official - seeks what might be called 'preferredness' or 'utility' in life. Each individual adjusts or makes decisions so as to maximize his utility as he sees it. In other words his behavior is generally purposeful, not random. He takes those actions that he believes to be best. This does not imply that he is highly hedonistic, selfish, callous, materialistic, immoral, or anything of the sort. The thousands of items that contribute to

Government Science Policy: An Evaluation, Organization for Economic Cooperation and Development, Paris, 1972.

Charles L. Schultze, The Politics and Eco-Public nomics of Spending, The Brookings Institution, Washington, DC, 1968.

I. C. R. Byatt, A. V. Cohen, "An Attempt to Quantify the Economic Benefits of Scientific Research", Department of Education and Science, Her Maj-London, 1969.

wants to have right without wrong, order without disorder, does not understand the principles of heaven and earth. He does not know how things hang together". -Chuang-tzu c. 275

Roland N. McKean, Public Spending, Mc-Graw-Hill, New York, 1968.

B.C.

Ibid., p. 13.

an individual's 'utility' in this sense include helping others, performing tasks well, playing and relaxing, exploring ideas, enjoying beautiful scenery and works of art, enjoying peace of mind, and adhering to moral codes and ethical rules – as well as having personal comfort, material goods, prestige, and so on."

"One might say that millions of individuals daily consult thousands of little cost-gain T-accounts as they seek preferred situations. Each person's decisions are based, not on one particular aspect of an action (e.g., its contribution to the nation's GNP, or the utility to this person of its contribution to GNP, or the utility of the action's impact on the probability of maintaining 'freedom'), but on weighing all the gains in utility against all the costs – as that person perceives them.

"Frequently, of course, a preliminary and intuitive calculus tells a citizen that the prospects of getting helpful information, of understanding the issue, and especially of influencing the outcome make it uneconomical to devote even a minute to thinking about a proposed outlay. After all, not many persons assiduously scan each year's Federal budget to decide whether or not they approve of each line item. A citizen may decide to ignore the matter; to adopt a simple rule of thumb, such as 'Whatever position Joe takes is the one I'll take'; to write letters and be active in organizations supporting his views; or to vote a straight party ticket. (Imperfect rules like following slogans, voting according to labels or other crude indicators, and thinking in stereotypes often make sense as soon as one recognizes that information is costly. As misleading as broad labels are, they still may be better than the attainable alternatives.)"

The general inability of the voter to involve her- or himself in every decision, owing to lack of time, lack of capacity of the human mind, or lack of resources to obtain the relevant information, goes a long way to explain the power of minority groups, organizations, even individuals, to change things. Many individuals will decide to "go along with Joe" if they perceive that Joe, like Pollution Probe, or Ralph Nader, is someone who *cares* (in the latter two examples, it must be admitted, there may also be an element of cheering on a David against a Goliath). The politicians, striving to receive signals from the electorate, or signals more specific than votes at election-time, tend to hear mostly sounds from the various vociferous interest-groups and interested-groups. They must use special probing and sampling techniques if they wish to discover the opinions of the great "silent majority."

"When we turn to politicians, legislators, and government officials, we find still more emphasis placed on gaining approval or support. . . . Their cost-gain statements or T-

Ibid., p. 15.

Ibid., p. 16.

accounts are filled with items like gains or losses of votes, gains or losses of support for their respective proposals, and gains or losses of time and convenience in dealing with colleagues and pressure groups. . . ."

From these commonsense beginnings, McKean applies principles from economic theory to develop a calculus of political influence and political decision. This approach has the advantage of emphasizing the processes of bargaining, of seeking advantageous trades, and of trading off one utility against another. By this process individuals combine and adjust their preferences into some kind of social result.

"The thousands of elements in utility functions – the items that yield utility – are in varying degrees substitutes for each other. Some amount of Effect A will compensate a person for giving up a unit of Effect B."

When a course of action becomes more costly (in a general sense) it will tend to be followed less relative to other actions.

The basic structure of democratic government may be simply characterized as an executive office (in Canada, the Cabinet) acting through a large and variously unwieldy bureaucratic system, and subject to legal and public constraints. The constraints of public opinion are stimulated, shaped, mobilized, and brought to bear on the executive through and by Parliament, through and by the many forms of the press, and through and by many varieties of specialized institutions for informing and/or influencing public opinion. Other, private, pressures also operate to influence government decisions.

Two very general criteria by which the citizens judge government actions are, first, rationality, that is, whether a decision is the best decision among alternatives or at least a good enough decision, in the light of the goals being pursued. The second criterion has more to do with those goals. Altruism might be defined as how one would like the other person to behave. We tend to rate a decision by a government individual higher to the degree we see him or her behaving altruistically rather than self-interestedly. Are the goals being pursued public goals, or are they private and special-interest goals? Thus public pressure acts to constrain government individuals to act, or be seen to act, more rationally and more altruistically than they otherwise would. (In McKean's terms, they may still be acting from self-interest, but these other complicating factors are now entered into their self-interest balance-sheets; whether their apparent altruism is heart-felt or not may not matter for practical purposes.) On the other hand, though it might not be necessary in a given case to prove which motive was acting, nevertheless without such unselfish elements as trust, generosity, empathy, love, and respect, no society would hold together. The conditions for these morally-restraining pressures being effective are, first, exposure or disclosure of the decision and the factors entering into it and, second, public ability

Ibid., p. 17.
to understand. It would be pointless to disclose details of a highly technical issue if there were no agent of public review capable of analysing and interpreting the technical aspects, and of penetrating the possibly obscurantist tactics of a politician or a government agency that might have something to hide. Furthermore, the public, or vocal segments of the public must be at least potentially *interested* in the issue.

But no matter how altruistically and rationally the Cabinet might try to behave, their good intentions can be frustrated by the bureaucracy. At every human node on the way to implementation, the decreed policy encounters actors with their own perceptions and their own interest to balance. When these encounters are confidential within the bureaucracy, the ennobling effects of public exposure are missing. The bureaucrat may prefer to avoid risk, may prefer to do things the old way, or may personally consider the new policy a mistake; he or she can use rules, procedures, delaying tactics, misleading memos, in many devious ways to frustrate the policy.

The cyberneticist would view the bureaucracy as an amplifier or servo-system, containing a sometimes large amount of distortion. To reduce the distortion, he would feed back information to the source of command - information that would reveal the disparity between the actual and the intended result. But he would know better than to attempt to transmit that information back *through* the bureaucracy: he would know that the information moving upward through the bureaucracy would suffer distortion at the human game-playing nodes at least as seriously as the orders moving downwards. Therefore the path that completes his feedback loop will bypass the bureaucracy by the most direct and low-distortion path he can devise. The path, in fact, already exists in some measure in the form of Parliament, a free press. and the various public-informing bodies referred to above. These constitute a multiplicity of paths that cross-check each other and thus improve fidelity. A further step is to recognize that making the feedback public opens the possibility that many individuals in the bureaucracy can respond to it without waiting for orders from the top. The field of responsibility is opened out.

In terms of the framework developed so far, the principal components of the science policy structure in Canada can be roughly identified and their functions interpreted. Like most countries, Canada contains a great variety of modes, more or less inadequate, by which technical knowledge enters to illuminate and influence the political processes – a spectrum of modes ranging from articulate individuals, through private lobbies and professional associations to quasi-governmental institutions and technically-expert agencies within one or other level of government. Here we propose to concentrate our attention on two agencies at the federal or national level unique to Canada – the Science Council of Canada, and the Ministry of State for Science

and Technology. These will serve as paradigms around which to structure discussion of the processes involved. It should then be possible to identify the analogous process and structures - their equivalents or their absence - at other levels of Canadian government and perhaps in other countries.

The Science Council of Canada, although supported by federal funds is intended to be an agency in the public circuit. It is an advisory council of 29 prestigious individuals, experienced in various aspects of science and technology, from various parts of the country (mostly from the industrial sector and the universities) appointed by the federal government. They serve for periods of three years, with about a third of the membership changing each year. The Council meets for two days at a time. five times a year, its members being fully employed in other positions the rest of the time. The Council is served by a fulltime professional staff and various combinations of hired consultants and voluntary committees for particular fact-finding studies. The purpose of the Council is to arouse public concern and raise public understanding, in matters involving science and technology, at the same time as to transmit to government its carefully considered opinions on what should be done. By exposing the issues or by exposing more desirable alternatives to government and to the general public - by being seen to advise the government in a certain way and by the government being seen, or not, to respond - the Science Council presses the government officials to give good reasons if they should act differently. Choices made for inappropriate reasons, or based on inadequate study, are made more difficult. The officials involved may still act in such a way, but the costs of doing so have been raised.

When the Council was first established, in 1966, it does not seem likely that the federal government was thinking in quite those terms. In fact, setting up the Science Council as a public body "like the Economic Council" but at the same time served in a staff capacity by the Science Secretariat of the Privy Council Office showed a certain ambivalence between the concept of a truly public body that would make research studies and analyses. possibly critical of the government, and a council of experienced impartial advisers who would discreetly and confidentially advise the Prime Minister. The matter was settled in the first two or three years as it became clear to the Chairman that, while he and G. B. Doern, Science the Council nominally reported to the Prime Minister, the Prime Minister was in practice so occupied with other affairs that an advisory relationship of verbal and confidential type simply was real, 1972. not going to materialize. Science Council advice would disappear into the mysterious circuitry of the Cabinet and its committees and secretariats. Advice the government did not like would likely never be heard of again. Without direct participation in the decision-making processes of Cabinet and interdepartmental committees, and without being privy to all the same information, the

The historical details are reviewed in G. B. Doern, P. Aucoin, eds., The Structures of Policy-Making in Canada, MacMillan, Toronto, 1971.

and Politics in Canada, McGill - Queen's University Press, MontCouncil would have existed in limbo. Its real political leverage, it seemed, was to be found via public exposure. Thus the Science Council became recognized as a component in the public circuit and was given its own staff, leaving the internal Cabinet advisory role to the Science Secretariat. Going public had the added advantage that the statements of the Council itself would be subject to the discipline of public criticism, including the technically-informed criticism from the scientific community.

However, the internal Science Secretariat did not fare much better in establishing direct personal advisory relationships with the Prime Minister. Science was no more important than many other policy concerns weighing upon the Prime Minister and the Cabinet. Even though given the title of Science Adviser to the Cabinet, the director of the Science Secretariat found his input was chiefly channelling through the Cabinet Secretary rather than by direct participation. Dissatisfaction with the weak political leverage of this arrangement, expressed by both the Science Council and the Senate Special Committee on Science Policy. resulted in the creation in 1971 of the Ministry of State for Science and Technology (MOSST) (which absorbed the Science Secretariat as the nucleus of a much larger staff). Now, it was hoped, the urgency of policy problems in science and technology would be carried into the "committee of Ministers" by an advocate of equal status.

It is all very well to say "equal status". However, in practical politics, Cabinet Ministers do not have equal status, their weight in Cabinet affairs tending to depend on the magnitude of their responsibilities and on the current political sensitivity of their departmental policies. In those terms, one might well wonder what influence the new ministry could have. Had a Department of Science been created, as some proposals had advocated, amalgamating the scientific activities of several operating departments - such as, fisheries, agriculture, energy, mines and resources, and the National Research Council - the new ministry might have been very weighty indeed, but that approach was rejected as unsound. Scientific knowledge is too integral to the intelligent conduct of those activities, and the priorities in research and development too closely related to operational goals and responsibilities to be hived off into a separate jurisdiction. Yet the need was felt for coordination, and some means was needed for policy assessment at the Cabinet level. The result was to implement a new concept: the "Ministry of State" as a new type of ministry, an internal policy coordinating or "horizontal" ministry, as distinguished from an administrative or "vertical" ministry. The concept of the horizontal ministry is a response to the growing complexity and interrelatedness of systems in the modern technologically-developed society and concomitantly in the modern government. The strictly compartmented approach will no longer do. MOSST was created at the centre of federal

government, to penetrate across the operational departments to coordinate activities in science and technology. To play such a role and at the same time compete at budget time for large expenditures of its own would be a conflict of interest, as the Glassco Commission noted with respect to the policy advisory function originally assigned to the National Research Council, before the NRC became responsible for operating large laboratories and grant programs. Similar situations where the Ministry of State concept seemed appropriate were *urban* problems, and protection of the *environment* (though the latter, for reasons that may be public some day, was mixed with a ministry of the older type by giving it large operating responsibilities in forestry, fisheries, and water resources).

A new type of ministry should be expected to have a new type of power. The ultimate ground for the influence of a Ministry of State must be found in the authority of knowledge, openly exposed. Just as the Science Council and other expert bodies in the public domain help to make possible public understanding of the scientific and technological factors pertinent to a decision, and thus pressure public decision makers toward rationality, so within the federal government, MOSST, by exposing in Cabinet the alternatives to and consequences of a technological decision advocated by a particular department should improve the rationality of Cabinet decisions. Put in other terms, MOSST is in the position of an information-linked meta-system with respect to the scientific and technological systems embedded in the various departments. Such power as it has over the systems must come from its ability to see and to put together the interrelationships; and to communicate a more holistic perspective to the systems, their higher authorities, and to the central policy and planning meta-system of the Government. It would, of course, be naïve to suppose that all *politics*, in the general sense, would be absent from the role of MOSST; there will be a particular kind of politics involved in getting those perspectives noted, understood, and agreed to by the various actors, and in obtaining the information on which they must be based.

A particular problem for MOSST arises from the negative aspects of its role. A weakness of the system for government science decisions in the past has been the "flim-flam" effect. Proposals have originated within departments and agencies from scientists interested in building great nuclear accelerators, and engineers interested in changing the face of the earth, and these proposals (backed by all kinds of technical analysis and justification) have been presented to non-technical politicians and accountants for decision. The decision makers have had little choice but to take the proposals at face value. The *Treasury Board* has in recent years tried to include in its complement an experienced scientist or two but this has hardly met the need. MOSST, now, is expected to play a technical audit and adversary role, acting as

"coordinate, not take over or direct; particular research groups will continue to interpret their goals mainly in terms of the missions of their departments." Canada, Royal Commission on Government Organization, Chairman, Ι. Grant Glassco, Vol. 4, Special Areas of Administration, Queen's Printer, Ottawa, 1963.

member of the central policy-integrating and goal-ordering metasystem (which includes Treasury Board) to tame the goals of the competing self-oriented systems and sub-systems. The problem is that this audit and cross-examining role may encounter resistance from the powerful government departments and agencies. To the extent that Mossr's attentions become consistently unwelcome, that is, to the extent that its negative role predominates, Mossr may meet many impediments in getting the information it needs. Its operations will be complicated by individual contests for dominance, sovereignty, and prestige. Will the separate systems recognize the value to them of the meta-system, and will they agree to its peculiar kind of authority? A great deal depends on how much the Cabinet and particularly the Prime Minister believe in the concept, and on how well MossT succeeds in establishing its credibility.

Much of this discussion has been put in the future tense, on the grounds that the Ministries of State are a new kind of organization, they are still developing their roles, and, if the party in power were to change, their functions might be changed again, or even eliminated altogether.

Regardless of particular governments and ministers, however, we interpret these new advisory and policy bodies as instances of much needed innovation to cope with modern conditions. The power of knowledge is all they have to work with – as distinct from the power of finance, or legal authority, or military might – but in an age of efficient communications and technicallycomplicated decisions that is far from negligible. Even when the government does not always take their advice, the mere existence of these bodies can have important effects. Providing they are competent, they are a potential threat to incompetence. Government departments on their own will devote a more conscientious attention to policy issues, whether or not the advisory body chooses to study their particular departmental activities. Understandably this extra effort is a pain, a cost, to the government officials, and they might prefer that the policy councils did not exist. However, as often as not, the department, especially if it prepares its case well, will find the policy council or ministry a useful ally.

Besides the Science Council, there are other quasiindependent public advisory institutions relevant to science policy, such as the Institute for Research on Public Policy, certain committees of the Senate (especially that convened by Senator Lamontagne), the Design Council, and the Economic Council of Canada. The Economic Council, for example, can hardly avoid being involved with science and technology, any more than science policy advisors can avoid economics. All these councils are supported to a greater or lesser degree by public funds, but are expected to advise the government, and the public, from an independent standpoint. In addition, there are various volun-

A Science Policy for Canada, Report of the Senate Special Committee on Science Policy, Queen's Printer, Ottawa, vol. 1, 1970, vol. 2, 1972, vol. 3, 1973. tary organizations and professional associations, such as the Association of the Scientific, Engineering and Technological Community of Canada (SCITEC), the Royal Society of Canada, the Chemical Institute of Canada, the Biological Council of Canada, the Canadian Association of Physicists, and so on, as well as individual scientists and engineers, all contributing to the public debate.

In the Canadian system, this debate focusses on direct confrontation with government in Parliament. Unfortunately, at the present time we find here a seriously weak link in the system. Neither in the separate political parties nor associated with Parliament itself are there adequate organizations for research. analysis, and information to provide the basis for a reasonable quality of debate on matters involving science and technology. There is some logic to the suggestion that the Science Council, as an agency in the public circuit, should report to Parliament rather than to the Minister of State for Science and Technology. yet that in itself would not be sufficient answer to the need. The need is for scientific and technologically-experienced staff to gather and interpret to the politician the various materials, and assist in developing a party position, on a short response time to meet the day-to-day moves of the government. The statements of the Science Council could provide a consistent longer-term backdrop against which to develop the shorter-term political positions and strategies. The political parties are familiar with the need for *legal* and *economic* expertise and have generally provided for it, if they do not already possess it in sufficient degree among their own Members of Parliament. It is time the Members of Parliament or their parties took the next steps necessary to equip themselves for governing in a technological age. The British House of Commons Select Committee on Science and Technology is a model worth studying.

Having reviewed in general terms the components of the political system for science policy in Canada, let us move on to discuss goals, and how those components work together to develop science policy in relation to those goals.

The first thing to note, as following from McKean's description of the interest-trading nature of the political process, is that *there can be no single best policy*, – that is, no uniquely right set of priorities. There will always be several, or many, sets, representing different trade-off formulas, that will be more or less acceptable to a social group or society at a given time. Even the unlikely event of unanimous agreement would not eliminate the possibility of the existence of an equally acceptable set, not to mention the possibility that a group of people can be unanimous and still choose unwisely. McKean illustrates the general problem by a simple example:

"Imagine that three men are choosing a book to be read by all three (or deciding anything else that effects all three). Roland McKean, *Public Spending*, McGraw-Hill, New York, 1968, p. 32.

If there is disagreement, should the criterion of the correct choice be the maximization of one man's utility, the maximization of one man's utility subject to constraints on the utility of others, decision by majority rule, the avoidance of violence, the maximization of aggregate utility (if individual utilities could be measured), or decision by voluntary exchange (which allows monetary 'bribes' and enables each person to maximize his utility so long as he does not reduce another person's utility)? Logic does not compel one to prefer any of these outcomes – there is no ultimately correct way to measure or even conceive of benefits and no test of the fundamentally correct course of action."

Most people, consciously or unconsciously, recognize this and do not expect perfection from their governments. The danger is that their standards relax and they become so tolerant that only an absolute crisis will arouse their participation. The criticism of government by press and public tends to be directed, not at the central or positive goals (whatever those may be), but at particular actions that seem to fall *below* some standard of rational management in the public interest. This is the first of several senses to be discussed in which the social approach to goals will be seen to have a *marginal* character – a process of policy formation by nibbling at the edges.

It is not true to say that all questions of goals and priorities culminate in the budgetary process. Often what is required is a policy or a legislative action that cannot be evaluated in costbenefit financial terms in any meaningful way – though *political* costs, certainly, may carry weight in the choice. Still, many of the processes of evaluation *are* brought to a focus finally in the budgeting process, with the Treasury Board or equivalent the centre of action, and the problems of deciding *priorities* often seems most urgent where the spending of money is concerned. Thus the problem of deciding budget priorities is one paradigm that needs discussion.

As consumers, we are used to the processes by which benefits are measured against costs in the market place. For a proper analysis we should have to diverge into a discussion of the economist's concept of utility functions. But for our purposes, it may suffice to remark on two essential features. First, we do not attempt to measure what a product or service does for us in any *absolute* sense, but only in a *relative* sense, relative to our income, and our need. Second, given that we can afford it at all in our scale of priorities, we answer the question, "should it cost *that* much?", not by measuring its cost against some *absolute* scale of value, but by measuring its cost against similar products serving the same need or against what it has cost us in the past; we depend on the mechanism of market competition to discipline the inefficiencies and on technological innovation to lower the cost. Naturally, the lower the cost, the more needs we can satisfy within our income. Always, however, we are operating comparatively, and, as the economist says, at the margin.

By analogy a kind of market process can be identified within the government, where Treasury Board acts as purchasing agent, and all the departments and ministries make sales pitches to it.* A nagging disadvantage of the "bureaucratic economy" is the virtual absence of free competition as a device for motivating motives efficiency - except perhaps in the work it contracts out to com- managers, netitive bid – but otherwise the problem of allocating funds among many competing needs can be recognized in an elementary through the bureaucsense as rather similar to that faced by the individual consumer. racy. Treasury Board We see the same problem of weighing incommensurate needs or aspirations, one against the other, within limited means, and the arbitration of these same processes of marginal comparative evaluation. There are processes. differences, on the other hand, that are important and are not always appreciated from the point of view of the individual consumer.

The first difference, which adds an extra dimension of difficulty, resides in the complexity of the relationship between individual goals, and social goals. The second difference arises from sheer difference in scale. The number, diversity, and magnitude of the questions become too great to be analyzed and integrated within one human skull. Somehow, in a process of synthesis involving many individuals, the social goals must be brought together with assessments of costs, technical and political opportunities, available resources, and possible consequences, to reach decisions expressed in legislation and government expenditure.

Clearly, the task is too enormous for a government to evaluate annually every expenditure in the economy, to a zero base-line, so to speak. What governments have to do, in fact, is assume that on the whole things are operating reasonably well - that the society, generally speaking, runs itself. Most revenue is committed to programs and mechanisms already established and ongoing. The government, like a good mechanic, then listens for signs of malfunction here and there, makes marginal improvements where feasible, and launches a few cautious new projects within its limited margin of freedom. Some existing programs are reviewed, and decisions are made whether they should grow or decline at a faster or slower rate. Rarely is a decision made that completely and abruptly terminates an existing institutionalized practice (imagine suddenly abolishing universities, or mineral depletion allowances). In this way, governments try to keep the total social mechanism in delicate, more or less stable, and manageable balance. Of course, in the event of war, revolution, or widespread economic and social breakdown, the problems are of a different order.

It is clear that this applies to relatively developed societies under relatively stable conditions. In less developed societies

*More exactly, the 'threat' of Treasury Board, along with the honest of brings about such processes at many levels down represents the culmination, final review, and "A Method for Planning and Assessing Technology against Relevant National Goals", Technology Assessment in a Dynamic Environment. Edited by M. Cetron, Gordon and Breach. New York, 1972.

M. Cetron, L. Connor, goals are usually pragmatic, positive, and simple; in developed societies where the elementary goals are being met in some ongoing fashion, the operating goals take on a different character. and it has been suggested they might more appropriately be called "concerns", or "areas of concern". (Canada in the aggregate is regarded as a politically stable, developed country but in particular regions it has development problems.)

Thus, in the Canadian context the list of government priorities for action, or the goals of a particular administration, do not in general amount to a complete list of all the fundamental goals of the society, or national goals, arranged in a nice order of priority. To be sure, a methodically-minded administration may maintain, in the background, a reminder list of goals such as those developed in the last chapter, which might more appropriately be called *criteria to steer by*, but the list of actions to be taken will usually take a much more pragmatic form, resembling nothing so much as a maintenance person's job list ("it sounds as if such and such a wheel needs oiling, and it is time to replace the homesfraddit with a newer model . . ."). In other terms we would say that this list, rather than an absolute, has a marginal quality, and is temporal and incomplete. Further, the federal list will have a different character from that of some provincial governments. It is the kind of list of goals that we find in a party election platform, or in the annual Speech from the Throne, in which the party in power sets out its intentions. In Appendix D, we give a set of priorities of this character, elicited during an interview with Mr. Olof Palme, then the Prime Minister of Sweden. This particular set is interesting in that it is a list of practical actions that could move the society specifically in one of the dimensions developed in Chapter IV, that is, toward a "just society". More often, a government's political intentions are not displayed so clearly in relation to a goal or principle, nor have they been arrived at in that way; the priorities the government gives to the general goals can only be inferred.

If we re-examined the list of national goals offered by the Science Council in Report No. 4, we would see that they exhibited some of this character also. Though the original intention may have been to present a complete or absolute list as a reference standard, in fact the Council put together a partial list, of items at the top of the present concern, from the Council viewpoint, and therefore partly "political."

The action of the Science Council in positing a list of national goals, hypothetical though it was intended to be, brings us to the central question. How, in fact, does or should a goal be placed onto a government's action list, and what do science and technology have to do with it? In particular, does a science policy institution take its policy goals as given, from some other source, or does it play a role in their formulation?

To some extent the answers depend on the generality of the

goals one is talking about. Goals as general as those listed in Chapter IV might be said to stand above all democratic governments, and therefore to be invariant of particular developments in science or technology. As soon, however, as we pass to a second, more specific stage, of formulating what might be called operational goals, or areas of concern, or even choosing orders of priority among the general goals, there is no question that the Science Council and other bodies of related type have important and legitimate roles to play in the choice. To see this, we have only to recall how in our own personal decisions the element of *feasibility* or *opportunity* counts heavily. Many times we choose a course of action which will enhance the satisfaction of some particular need with relative certainty, in preference to another course of action which may pursue some higher goal or more strongly felt need but which is less likely to succeed. That is to say, in some mysterious way what we weigh in the balance is a sum or multiplication of how much we want something with how likely we are to get it. Only the mentally disordered waste their resources seeking what is beyond all possibility. (This does not mean that it is abnormal or unreasonable to keep some high goal constantly in mind waiting for an opportunity.) The importance of the role of knowledge, and technique, in assessing what is possible, or likely to become possible, is undeniable.

Likewise, our choices of action depend on what we can foresee of the consequences, and again technique and knowledge enter if we are going to be able to understand and predict the consequences of action in a technological world. The implications of nuclear weaponry for international diplomacy illustrate the point. In science policy, the process of evaluating the positive and negative secondary and tertiary consequences of an action has been dignified with the name technology assessment. It inevitably contains a high element of *forecasting*. Although to quite an extent technology tends to develop according to a logic of its own and so a strictly technological forecasting is feasible, it is more generally the case that technological developments and their consequences depend also on other social, economic, and political developments and cannot be predicted or assessed in isolation. Furthermore, the process of assessment can only be done in relation to values and social goals, that is, "assessment" implies that one has certain goals and values in mind.

Thus, one must conclude that the evaluation of opportunities, and the assessment of likely consequences, and therefore the setting of operational goals, should be participatory and interactive processes, requiring a *dialogue* between human aspirations and know-how – neither a trickling down of goals from technically ill-informed elected representatives nor a feeding upwards of technological imperatives from socially insensitive technocrats.

At this point, as an aside, speculation could lead in two directions. We could take the view that science policy structures are temporary phenomena, necessary only until the society generally overcomes its inherited "two-cultures" educational gap. Or we could take a view that there will always be a gap that needs bridging between technical specialization (of all kinds) and mass culture. Either view, however, does not get around the present practicalities, for which dialogue is the appropriate approach.

A simple illustration of the role of "technical opportunities" in the national science policy can be found in the embarrassment of the U.S. government not long ago at finding itself with a surplus of highly educated and specialized scientists and engineers, following decisions to cut back heavily in expenditures on Defence and the Space program. One of the actions taken by former President Nixon was to appoint as special consultant Mr. William M. Magruder, former director of the SST program, assigning him the task (backed up by the President's Office of Science and Technology) of "searching for ways to apply high technology to solving social and economic problems." As reported in the National Journal (2 October 1971), "some of the areas Magruder said are ripe for technological application are health care, urban-suburban development, urban transportation. productivity, natural disaster prediction and prevention, education and communications." What the final list looked like we do not know, but presumably it was reflected, politically modified. in President Nixon's "Message on the Importance of Our Investment in Science and Technology" which was sent to the Congress on 16 March 1972. In that message, two or three items had been dropped from Magruder's early statement, and clean energy, drug control, and foreign aid were added. The composite list bears some resemblance to the list of suggested "major programs" in Science Council Report No. 4.

This comparison invites two observations. First, the "technological opportunities" approach to science policy will typically generate such lists as an input to the political process. Second the resemblance between lists may not be as significant as one might first suppose. Such a list, far from being a unique and inspired recognition of the scientific and technological possibilities of our time, may be closer to being simply a partial list of the basic systems enumerated in Chapter III. One of the prime responsibilities (and goals) of government is to keep those systems operating well, introducing technical improvements as they become feasible. Thus the first step in being methodical about exploiting the opportunities offered by science and technology, is, consciously or unconsciously, to run down the list of basic systems that serve the society. The second step then would be to take account of the foreseeable possibilities so that the final list developed would represent the intersection of the system needs with technological opportunities.

In taking specific actions within its role as systems mechanic and systems operator, a government will consider at the same time a third dimension - its general goals and values, for example, national self-preservation, opportunity for human development, human freedom, justice and equity, democratic participation, stability and progress, diversity, the overview of the whole, and thought for the future. It will have to balance one off against another.

The total process of political bargaining, and matching goals with technological opportunities, depends on the presence of proponents for science and technology. Fortunately, scientists and engineers, being generally interested in their work and enthusiastic about its possibilities, tend automatically to play that role. It is inevitable, unfortunately, that sometimes, when some of the consequences of an applied science or a technology are antisocial, the zealous advocates of technological solutions come to be regarded with the same opprobrium accorded crooked salesmen and drug pushers. There are moldy logs in every woodpile. but this should not blind us to the fact that the *general* process at work, as in the market place, is a process of arranging advantageous trades, advantageous to both parties. What we do seem to require increasingly, just as we do in the consumer market place, are technically-sophisticated watchdogs over the side-effects or spillovers from the basic binary transactions. This points to another role for the science policy bodies to play.

At the "grass-roots" level, of course, all types of pressure groups will be found, from technology zealots to the guardians of primeval wilderness. Within the government, the operating departments can usually be relied upon to play the role of advocate of particular technological solutions, and therefore the science policy Ministry, while it may play a useful role in suggesting a broader range of alternatives, may find one of its most important roles to be that of technology assessment. Dealing largely with spillover effects or secondary impacts, technology assessment naturally includes environmental effects among its main concerns. What the role of the MOSST will be, relative to the Department of Environment, as it is at present set up, remains to be resolved. The role of the Science Council also presents interesting problems. Does the Council function sometimes as advocate, sometimes as assessor? Does it play both roles simultaneously, or alternate? Or does it place its emphasis on assessment, depending on the professional associations, the industrial corporations, and the general public; to provide plenty Nigel Calder, Techof advocates? (Some basis for these doubts is to be found in nopolis - Social Con-Calder's suggestion that scientists and technologists tend to divide naturally into two opposing types, that he calls Zealots, and Mugwumps.) Some of the answers may become clearer only 1969. with experience.

It is important to keep in mind that the "classical" mode of democratic political control, through periodically elected representatives, who then exert authority downwards, is only one

trol of the Uses of Science, MacGibbon and Kee, London, mode through which the modern citizen influences the behaviour of the systems in her or his own interests. There are other checks and balances, other democratic modes, many of them bypassing the electoral-political loop. So, in another sense to that introduced above, the central executive of the government can function, and can select operational goals, without necessarily being all-encompassing in its scope. The periodic vote, though an essential safeguard, has never been very indicative for specific issues and has been losing significance as a method of communication, from people to government, relative to the continuous use of mass communications media, opinion sampling. forums, white papers, confrontation, and other techniques. The behaviour of bureaucracies can be influenced at lower levels. without necessarily going by the hierarchic route at all. One could note a similar feature of the market system. There are many ways in which manufacturers are influenced to produce this product or that, besides the final criterion of market success. In fact, costs of tooling, and planning, for large-scale industry are such that a considerable exploration and mutual shaping of ideas and preferences before actual marketing may be advantageous to both producer and consumer, not to mention the extent to which industrial managements do modify their behaviour in response to social pressures, both from without and within. Indeed various radical citizens' action groups have been exploring ways to enhance the efficacy of such processes.

An example of this short-circuit type of behaviour by a bureaucracy was provided by the RANN (Research Applied to National Needs) program of the National Science Foundation in the U.S. The agency could have sought to obtain some sort of list of the national needs, and their priorities, from the regular political bodies. Instead, feeling that for its purposes the message by then would have been too seriously distorted by other considerations, including a heavy bias toward present "realities", the agency chose to do its own direct sampling of public opinion, to discover what problems, potentially amenable to scientific and technological solutions, bothered people the most. This was found to be a valuable supplement to, though not a replacement for, the policy statements available at the federal government level from official and quasi-official sources.

In a way it is fortunate that the role of a particular political administration is less critical than might be supposed. It means that a government has some freedom to be innovative, to be conservative, and to make mistakes, without bringing the society down in ruins.

Conversely, along with this diffusion of control, the responsibility of the civil service tends to increase. The simple "pure bureaucracy" administers rules, and follows orders from the top. It passes all responsibility back up to the top. The pure bureaucrat lives a secure and sheltered life. In contrast, modern

Hazel Henderson, "Toward Managing Social Conflict", Harvard Business Review, May-June 1971. bureaucracy is being democratized and decentralized - not so much because of any particular political theory, but because the complexity of the system necessitates it.

In fact, the decision-making power over the use of science and technology is pluralistically distributed throughout the Canadian society. Recognizing this, the Science Council has adopted a "national" role, from which it speaks not only to the federal government, but also to provincial governments, universities, corporations, associations, as well as to the general public. To illuminate issues and choices only in terms of what the federal government might do, would severely limit and distort a reader's appreciation of where the real problems lie, and who the key actors are.

The pluralistic approach is particularly appropriate to scientific research. The academic research scientist, traditionally the epitome of free choice, as regards the subject matter of research, may not need to be nudged toward one area rather than another by political goals transmitted by a granting agency. Once made aware that certain social issues exist, she or he will often on their own initiative choose different fields of research. The paths by which social awareness is raised are many, besides the electoral-political-policy route. A direct interaction by participation in Science Council studies is one conceivable route, which has been observed to have effect in some instances.

Having emphasized the somewhat peripheral, marginal, and remedial character of government action, let us go on to discuss in a more specific way the role of science and technology in a government's choice of priorities. As an example, suppose a government were to be perfectly methodical and rational about assigning priority ratings to a series of projects or programs involving research and development. What would have to be involved in such a procedure? To begin with, the procedure would have to make explicit the main features of what experienced people try to do intuitively when they face that problem. Since R & D programs have their major benefits far in the future. and always contain uncertainties as to costs and results, the procedure which is in fact practised by good research management (or at least should be attempted) is rather more complex than has been generally credited. (What is being dealt with here is not the simpler problem of an agency disbursing funds to pure scientists out of a set budget, though some ideas of science policy would attempt to reduce it to that, when they phrase their recommendations in terms of total "science budget.")

If a *quantity* were to be evaluated and written down that would measure the rating of a given program, its symbolic representation might look like the following. It would be a number P arrived at by multiplying together several terms:

$$P = U \times T \times D \times R \times A$$

• U would be a complex sum of *utility functions* or a matrix

of utility functions (assuming that they could be written, and that they could be added – both somewhat dubious assumptions). Each (marginal) utility function would appear as a coefficient expressing the current weight attached to improvement in this or that goal area, in other words how important it is to the society (and/or individuals, and/or the government) to move toward that goal. Some coefficients might have a high value either because some improvement is extremely important to a small sector or because it is modestly important to a broad sector. In keeping with the ideas of government role developed above, actions that move toward the cure of some perceived trouble-spot or disease in the body politic would tend to be valued more highly than a marginal positive improvement in a generally satisfactory average welfare. The marginal-utility-function concept would tend to express such features automatically, in that the function would have a low value where satisfaction of the related needs was already at a high level and the benefit of further improvements would be marginally low. The time variable would have to enter most terms, to convey the idea that some Utilities might be very high if the program were initiated immediately, but rapidly drop to zero if delayed. (Examples could be found in dynamicallycompetitive situations in industry, or in actions to relieve seasonal unemployment, or in actions to win votes in the next election.) Also, most Utilities of R & D will be in the future, with various pay-off times. Some Utilities, such as training or learning value and job satisfaction, might be immediate, or at least begin immediately. Needless to say, any goals toward which the proposed project was not expected to contribute could be omitted.

• T would be a Technological Opportunities function. It would express the matrix of new opportunities that the project under consideration would be expected to open up, that the society could take advantage of, to move toward its goals. Among these would be opportunities offered by technology to cure or reduce problems recognized in U, some of these problems possibly having technological origins. The coefficients in Twould be highly probabilistic, since they would have to estimate the *likelihood* of the various outcomes. Like the U matrix, its terms would be functions of time. Thus the product of U and Ttaken together would express the fact that decisions to move toward certain goals, or to choose certain intermediate or operational goals, are taken on the basis of the *conjunction* of desirability and feasibility, not on either alone.

• D would be a resources Demand function. It would express the expected need of the project for money, manpower and special facilities. Also, the project would require expenditures of a magnitude that varies with time. Some programs would require a large initial capital expenditure. Others might start small but entail large expenditures in the future to realize the pay-off.

• R would be a Resources availability function. It would

express the availability of financial resources, natural resources, manpower, and special facilities, now and in the future. Special capabilities or experience might exist that could be exploited at a certain time, for example, Canadian PhD chemists. Financially, a certain Utility or a certain project might require a certain scale of expenditure before any measurable benefits could be realized (a threshold effect): if such a scale of expenditure is out of the question, one should find that the priority product P is equal to zero; the terms U, D, and R would not intersect, and their product would be zero.

• A is an Assessment function. Difficult as it may be to do before the fact, it is now recognized that, wherever possible, proposed new developments in science and technology should be examined and assessed not only for the expected benefits but also for the expected side-effects, external costs, and social disbenefits to which they may give rise. In some cases, predictable deleterious effects could, and should, seriously downrate an otherwise desirable project.

This analysis is far from reaching a quantifiable stage. Nevertheless one or two features are clear. First, the *priority* product P is a complicated quantity. Whether it can ever meaningfully be reduced to a single number is doubtful, and whether such numbers could meaningfully be derived and applied across a broad spectrum of social choices we might well expect to be beyond all possibility. Nevertheless, the bothersome fact remains that allocation decisions of this type *are* made by governments – and by business corporations, for that matter, in a narrower sphere. How?

From the viewpoint of science policy, we are particularly concerned with the role of bodies like Science Councils, and Science and Technology Ministries, in such decisions. Clearly, no Science Council, so far, has ever been set up that could perform the entire calculation within its own organization, even in principle, and it is possible that none ever will be. It is clear that a Science Council should, in principle, be in a position to evaluate T (scientific and technological opportunities), D (Cost estimates and estimates of manpower needs, etc.), and parts of A (technology assessment). It should also be knowledgeable about some aspects of R (particularly specialized manpower resources, experience, and facilities). But U (utilities and goals) is intimately involved with social and private priorities, and with the politicalsocial-economic systems. What the Science Council of Canada has done, however, and will probably continue to do, is to make a provisional first guess at what the social goals are, or are coming to be, in order to improve the relevance of its recommendations, and reduce the effort that otherwise might be wasted in the study and promotion of ideas that, politically, could never come to anything. It takes some risk in doing this that it may misread the climate of public opinion, and that it may mistake

M. Gibbons, R. Voyer, A Technology Assessment System, Science Council of Canada, Background Study No. 30, Information Canada, Ottawa, 1974. its own conservatism for a judgment of political feasibility; thus refraining from putting forward options that the political bodies and various factions of the public at large would at least like to consider. What a body like the Science Council can also do, besides promoting technological opportunities, is to assist in identifying where some social problem has technological roots - a form of assessment in hindsight. The Assessment term, A, is greatly dependent on social priorities – on the trade-offs people are willing to make, because practically no innovation will be a case of all benefits and no costs. The extent to which there can be a methodology of technology assessment which can be entirely objective, or value-independent is being debated among its early promoters and practitioners. So far, the experience suggests that a plurality of assessments will need to be heard, and the adjudication will be political. Finally, the resources term, R, particularly the financial resources, can never be assumed or taken for granted by a Science Council, but must involve decisions by such bodies as Cabinet, Parliament, and Treasury Board, where all the other competing demands for public resources converge. (It is assumed that levels of government other than federal have analogous structures, even though they may be given different names.)

The policy problem for a particular department or agency is relatively much simpler, since its goals and generally its budget are given, within rough limits.

However the product P is arrived at in our present system, it is clear that involved in the process are pragmatic negotiations, trade-offs, pressures, technical information, forecasts, conjectures, "gut feelings", personalities, and other inputs into the political mechanism. It is sometimes a process in which the whole society is involved. In any case it is not something that a Science Council can work out and hand to the government on a plate, or in a handsome red binding. The federal Cabinet, and each government decision-making group at lower level, sits at the centre of an entire constellation of inputs, of which Science Council advice is only one. On that account, the Council can often serve best by presenting its advice in the form of a range of options, with its assessment of the consequences of each.

The reader may be disappointed to find here no grand scheme or flow-chart to simplify and systematize the processes by which operational goal priorities are arrived at in a democracy. But he or she could not have expected otherwise, as long as our intention is to deal with realities rather than with idealized abstractions.

In spite of the apparent intractability of the subject, it will be useful to pursue it somewhat further, in particular to clarify the role of a body like the Science Council in the democratic process, so far as it is at present understood. The Council may be seen as one of various new institutional forms being tried out

"one characteristic of policy-making important for our method is worth noting here and now: its complexity and apparent disorder."

-Charles E. Lindlom, *The Policy-Making Process*, Prentice-Hall, 1968. in the Western democracies to improve the process of government "Policy research orin a world that is increasingly technologically complex. It represents an attempt to move forward from the older processes of political decision making based on negotiation between influential power blocs, military, political, or economic, to processes of decision making based on information, communication, knowledge, and rational argument. To be sure, the older processes will continue to be present, but to the extent that decisions are rational and based on knowledge - and to the extent that the reasons and the knowledge are public - one can hope that the base of democratic participation will reach farther down. The average citizen will feel less constrained to ally to the old power blocs in order to have any influence. Thus the formation of the Science Council can be interpreted as a government move to improve the mechanism of democratic participation (one of its prime goals), with the Council playing a catalysing role between public opinion, the community of experts, and government policy. Some readers will want It can also be seen as representing some shift of power toward a to argue this contennew "technocratic" base, with that base - depending on certain safeguards - being probably inherently more democratic (the power tending to be less hierarchically concentrated).

The concept of the Science Council's role, as it seems to be understood at present, can be displayed in greater detail in the following terms: stimulation, rationalization, negotiation, and reconcile specialist exarbitration.

Stimulation is the process by which the public is informed and stimulated into intelligent discussion of issues affecting their interest. New ideas can be injected, new proposals made, new knowledge and information spread around, new problems made visible, new aspirations or ideologies articulated – all originating from many diverse points in the social fabric. The universities play an increasing role as their enrolments involve a growing proportion of the population. Governments, having decisions to make and policies to formulate, may choose deliberately to stimulate public involvement and debate. This is what the Canadian federal government did by publishing the Benson White Paper on Taxation. It is what the U.K. government did by publishing a Green Paper on Industrial Research and Development in Government Laboratories. It is what the Science Council hopes to do when publishing reports, and when involving large numbers of the scientific and technical community in committees and seminars. Fundamentally each individual in the society should have the opportunity to decide what options he or she prefers, but it is preferable that he or she not have to choose in ignorance or from inadequate information.

Rationalization is used here, not in the sense of "specious justification," nor in the sense of eliminating wasteful activities from an organization, but in the sense of winnowing truth from falsehood, knowledge from ignorance, and good argument from

ganizations are a main modern invention in government, directed at improving symbiosis between power and knowledge.'

-Yehezkel Dror, Ventures in Policy Sciences, American Elsevier, New York, 1971, p. 285.

tion.

"The prime problem in social control of the uses of science is to pertise and long-range planning with the generalism of democracy. It must be done in such a way that the wishes of the ordinary citizen are heeded and the experts neither dictate nor bow to administrative government. The only solution is to bring experts and the public face to face in a continuous dialogue about goals." -Nigel Calder, op. cit., p. 271.

"Preferable policymaking involves an effort to increase rationality of content, through more explication of goals, extensive search for new alternatives, conscious attempts to elaborate expectations, with an explicit cutoff point, and some formulation of decision criteria." -Dror, op. cit., p. 261.

bad in the democratic debating process. With the growth in electronic communications the intensity of public discourse tends to rise, like the rise in pitch of conversation at a cocktail party. With so many people shouting at the same time, how does a government or how does anyone know whom to believe?

Schon has noted the importance of "ideas in good currency" for influencing the course of policy. "The phrase 'emergence of ideas in good currency' is a way of talking about the process by which new problems come to the attention of the public and of the . . . government and acquire potency for action. This process is one facet of the government-as-information process. In terms of the cybernetic model, it is the process by which government senses the problems it should be responding to."

The ideas in good currency at any one time are usually few and simple, and may change almost overnight. In the U.S. in the late fifties the magic idea was to compete with the Russians. Later, attention shifted to the decline of the cities, pollution, women's rights and, most recently, rising food prices and the energy crisis. A current idea may amount to little more than a catchy phrase or a journalistic fad, or it may represent the crystallization of a concern that has been building slowly for many years. Powerful as these ideas can be for moving politicians, however, the time lags in the process are such that by the time an idea gains currency, it may be late in the game. The popular government response may by then be inappropriate to the true situation. Thus a body like the Science Council can have an important function, using its rational analysis and judgment to anticipate and speed up the acceptance of sound ideas into good currency, while discounting and hastening the departure of the ill-considered or unsound. By taking seriously an idea, a prestigious institution can immediately give it a credibility it did not have before.

The function of improving the rationality of current discourse is made even more necessary by the efficiency of modern electronic communications. Even if the media did not distort in fact or by selection, they would still create problems, because the capacities of individual human minds are limited. People saturate, and all messages begin to seem of equal importance (or of no importance). New systems are needed to cope with the information explosion. Scientists, because their business is to establish truth, are expected to play a special role (if a scientist lapses into emotionally-motivated distortions or propaganda she or he tends to undermine the value of the one thing he has to contribute). A group of scientifically-knowledgeable men and women, such as the Science Council, might be thought of, by careful consensus and analysis, as attempting to establish anchor points along the advancing front of rational public discourse.

In theory this is undoubtedly what the Council should aim to do, but it would be a mistake to underestimate the difficulty

Donald A. Schon, "Maintaining an Adaptive National Government", chapter in *The Future of the United States Government*, edited by Harvey S. Perloff, Braziller, New York, 1971. of the role. Recalling the diversity of goals and values in the population, as emphasized in the earlier sections of this study. should be sufficient to remind us that it will often be all too easy for such a body of people to confuse their own habitual values "Extrarational procesand beliefs with the voice of objective or scientific rationality; Council members may find themselves implicitly or explicitly defending the socio-economic status quo, or the platform of a particular political party, rather than considering a proposal on its merits. Such an issue arose, for example, when the Council found that it had to consider the effects of land speculation, in connection with proposals to bring technological solutions to some of our urban problems (Science Council Report No. 14). As it turned out, an acceptable compromise was found, but the holistic impressions deevent drew attention to the fact that there is no such thing as the purely rational issue. The always incomplete analysis and incomplete information has to be filled out and integrated by intuition and judgment. The bounds of knowledge, the valid scope of intellectual analysis in conducting human affairs must be recognized. Yet how does one recognize the boundaries except by carrying rationality as far as it will go? And how does one distinguish between a "rational" intuition and an "irrational" prejudice? At this point the question as to how far the ideal behaviour is possible - and, for that matter, what is the ideal behaviour, must be left unresolved.

Yet, these are serious questions. All policy recommendations are in some degree normative, that is, they deal with things as they should be, they involve values and moral principles. To what extent should the Science Council or must the Science Council assume that our present liberal, capitalistic, mixed, socially-oriented economy is in all respects as it should be? Can such a council be apolitical?

Negotiation is a process of reaching acceptable solutions or compromises among competing interests. The Council members are appointed from a broad range of interest perspectives – from different regions, technical specialties, economic sectors, levels of government and, for that matter, different religions, different languages, and different sexes. They are not "representatives" in any proper political sense, but they inevitably have different scales of values, different priorities, different beliefs, different allegiances, and different zones of influence. Inevitably on many things they do not see eye to eye. Thus, even within areas heavily concerned with science and technology there are values, emotions, and prejudices to contend with, and a mini-political process has to take place in searching for agreement. (When the Senate Special Committee on Science Policy urged the scientists and engineers to form an organization to speak with one voice they greatly overestimated the homogeneity of interests involved.) At times the government may wish it could act like the industrial manager who, finding three of his department managers arguing

ses play a significant role in preferable policy-making on complex issues. This is not only unavoidable because of lack of resources and capacity for complete rationality, but, in fact makes a positive contribution ... intuitive judgment. rived from immersion in a situation . . . creative invention of new alternatives . . .'

—Dror, op.cit., p. 261.

for larger budgets, tells them, "The total budget next year for all three of you can only be up 5 percent from this year - now all of you go into that room over there and come back when you've reached a solution you can live with." There have been occasions when the Science Council has tried to respond to such expectations, as when it was asked to advise on policy for the building of large telescopes. To some extent it has been possible for the Council to act as mediator within the goals of a single discipline, but even there the experience with the astronomers is illustrative: no single solution would satisfy all the astronomers, and the budget priorities were such that the Cabinet was not willing to consider more than a single solution - nor was the Cabinet prepared to take the political risk of alienating part of the community. Action, in effect, was postponed until the astronomers themselves could reach a compromise. The advice of the Council was helpful to the government, in revealing the issues and possible solutions, but the Council itself was not in the position to make the definitive decision.

However, most problems the Science Council has considered important, particularly those involving applied science and technology, have had much broader social ramifications. When that is the case, since it lacks legitimate representative authority, as well as lacking information and expertise in some of the other matters that would have to be considered by a government in reaching a political decision, the Council is often limited in how far it can properly go in negotiating a consensus, and its more proper function then is to present the government and the public with a set of cogently-outlined alternatives. Besides, the differences remaining after rationalization has gone as far as it can are usually honest differences based on different value-sets or different ideologies, and it is proper that they be settled in some broader forum.

Arbitration is used here in the sense of a final, arbitrary if necessary, decision on a course of action. Even though equally valid and compatible options may exist, one may have to be chosen. In some cases it is the Cabinet, the Prime Minister, a Parliamentary vote, or the mayor of a city that does the job. Farther down the pole, it may be a research funding agency that finally decides which scientist shall have his work supported and which shall not. In any case, since the Science Council is not an operating or executive agency, it would not seem to have much of a role of this type. Originally, it might have been thought that it had, but experience and analysis have shown that it was not created with the appropriate structure or in the appropriate place in the government to make that possible. It is quite different with the new Ministry of State for Science and Technology, since the Minister participates directly in Cabinet decisions.

To complete this study, so far as understanding will allow at this time, the functions of these science policy bodies will now briefly be reviewed in relation to some familiar techniques of government decision making. These techniques are identified as cost-benefit analysis, planned-program-budgeting, piece-wise incremental, trouble-shooting, crisis avoidance, trial and error, satisficing, iterative cycling, grasping-at-straws, and comprehensive planning.

Cost-benefit analysis has been mentioned before in this study, as being, in a general sense, the basic technique of all decision making. However, in the context of discussing *technique*, it is commonly intended to put the emphasis on analysis, numerically quantified wherever possible. Since the basic purpose of cost-benefit analysis is to increase the rationality of decisions by laying out as methodically as possible the various alternatives and their implications, its value can hardly be questioned from the standpoint of science policy, which essentially has the same aim. However, some reservations should be kept in mind. There is invariably a tendency to restrict the universe of considerations to those factors which *are* quantifiable, and quantifiable in dollars - this procedure can introduce such serious distortions as to make many so-called analyses worse than useless. Where some benefits and costs can reasonably be translated into dollars, a sensibly cautious procedure is to say "the dollar equivalent of the benefits is greater than . . ." or "the identifiable costs are not less than . . ." Moreover, when comparing alternative projects, a simple criterion of maximizing the cost-benefit ratio does not necessarily lead to the right decision, particularly when risk, uncertainty, and future benefits or costs must be taken into account. It is more serious to place an excessive concreteness on the value of a dollar or the significance of a price, particularly when technological change is involved. Market prices are relative, and are marginally compared; they are related to the cost of production of an article, and may have little relation to what the article may technologically do, or what other costs it may save. To evaluate a technological change by its contribution to GNP may be significant, misleading, or irrelevant. For all of these reasons policy review bodies can be useful. From their independent position and broader point of view they may be able to identify important factors that have not been considered, and they can act as critic and conscience to so-called analyses that are biased or specious.

Planned-program-budgeting (PPB) is an extension of costbenefit analysis, in the sense that there is an explicit intention to identify the goals (benefits) of a department or program, and to evaluate performance or progress toward those goals against costs. As a technique, it was most successful in application to defence expenditures, where operational goals could be clearly defined. Applied to other areas its hoped-for precision has proved illusory, and it will not be dignified with a long discussion here. This is not to say that the *attempt* to use a methodical approach, even a very primitive one, does not have salutary effects. It very often does. Although criteria by which expenditures can be evaluated against output, or performance, in relation to purpose or goal are almost non-existent, the demand to justify what one is doing can bring about a healthy introspection which will accomplish some of the desired ends, namely, a focussing of effort, a pruning of inefficiencies, and a more explicit identification of goals. In that sense, some of the changes in budget format brought about under this heading have undoubtedly been worthwhile from the standpoint of internal government management. They have served as a partial antidote to the tendency of bureaucracies to routinize themselves and to grow incrementally year after year without reference to their original function. The change will be even more worthwhile if they build the basis of a common language in which policies can be more intelligently discussed among groups both inside and outside the government. Moreover, the element of planning in PPB, requiring projection of costs five years ahead, is useful insurance against the foot-inthe-door technique by which many dubious projects otherwise get started when budgeting is strictly year to year.

The method is sometimes known as "muddling through."

Piece-wise incremental refers to the approach mentioned before, which is based on the assumption that the society is an ongoing mechanism, operating reasonably well. Therefore changes can be made piece-wise, one aspect at a time, and in increments up or down from what was being done before. Although the technique is in universal use, students of public policy are aware that it does not always work. There are cases when the past is not a good guide to the future. (Technologies such as television, and computers, are quantum jumps in novelty for the human society.) There are cases where a long series of short-range incremental decisions simply compounds the problem. Governments can paint themselves into corners. In such cases presumably it would be the function of the Science Council and other long-range public policy critics to draw attention to what is happening and what may happen. This has the interesting implication that, while the governments and other institutions may get by without explicit goals, except in an incremental or marginal sense, taking most goals for granted, a Science Council cannot escape its responsibility to question the long-range goals. A goal framework is necessary against which to assess the directions being taken by the players of "blind man's buff." Another danger of the incremental approach, when it proceeds simply by extrapolation of the past, is its insensitivity. Values and goals in the society may have been undergoing rapid and widespread change, and internal tensions may reach crisis proportions before the system responds. By then there may not be an "incremental" solution.

Trouble-shooting is closely related to the above. It is analogous to the approach of the medical practitioner treating disease

in the generally healthy patient. His task is much easier, in a sense, if he waits for clear symptoms of trouble, then sets about to cure the implicated organ. He is sometimes in difficulties when the compensating homeostatic systems in the body have delaved or disguised the symptoms of disorder until breakdown is wide- An ounce of prevenspread and disastrous. No formal ordering of priorities need exist, not at least before the fact, any more than the individual ordinarily gives thought to which of his basic needs is more basic, or whether the health of his lungs is more important than the health of his liver. The use of analogy may not seem to accord to this approach the importance it deserves. For the developed and generally stable society it is perhaps the most basic principle. It corresponds to the approach mentioned above, of dealing not with absolute goals but with "areas of concern." Cybernetic theory would endorse the approach, in the respect that a system is likely to respond most effectively if the signal or indicator on which it bases its action is such that successful action will minimize the indication or bring it to zero. For the system, such a goal will be more operational and precise than a goal of, for instance, achieving a vaguely specified "improvement" in a general level of welfare. Accordingly, most social indicators might best be designed to measure the magnitude of the *ill-fare*, or the disease in the body politic. An example might be taken from the field of housing. A political party, or a government agency, always likes to create a good impression by speaking in terms of how many thousands of housing starts were made last year, but a more cybernetically-meaningful and sensitive criterion for the society would be to keep score on how many people are still without reasonable accommodation. However, the troubleshooting approach, being closely related to the "piece-wise incremental" deserves the same comment as above regarding the need for periodic assessment in relation to long-range goals. Also, the success of the approach depends on constant and sensitive diagnosis.

Crisis Avoidance. A stable society tends not to be aware of its goals. They are implicit and generally unquestioned. The policies of its governments may be more easily explained in terms of what they are avoiding, than what they are positively seeking. A. D. Chambers, of the University of British Columbia group working on the modelling of social systems, draws the analogy from the behaviour of some of the computer models to suggest that a society tries to maintain itself in a "saucer-shaped" region of stability. Various signals manifest themselves as the edge of the saucer is approached, such as social violence, unemployment, inflation, deteriorating environment. Governments are satisfied if they can back the society away from those threatened instabilities or crises toward the centre of the saucer again - without overshooting to a new crisis at the other edge. Again it tends to be a short-term approach. A longer-term look, from the stand-

tion is worth a pound of cure. But how do we know what to prevent?

point of science policy, might reveal that some technological approaches, (e.g., technological monocultures, and piling one "technological fix" on top of another) would narrow the region of stability so that equilibrium is more and more critical, and disastrous breakdowns become sooner or later inevitable. Urban policies with regard to the automobile may be a case in point.

The tendencies of governments to behave in these ways reflect only the tendency of most people in the society. Problems that get worse gradually go unnoticed. It is said that a frog, in water that is gradually warmed, will die because at no point will it decide to jump, until it is too late. Reformers know, or soon discover, that they can expect no action unless the problem that concerns them can be presented as a crisis. Certain problems of the cities have been problems for a hundred or even a thousand years. Some, to be sure, have been getting worse, but in other respects it is that our values and our standards have changed, so that what was formerly put up with we are no longer prepared to tolerate. Hence, the "urban crisis." It will often be the responsibility of a body like the Science Council to awaken the dozing frog, and to do so it may have to present its warning in the form of impending crisis.

Trial and error could also be called innovate and see. Governments not only have freedom to innovate but innovation in systems and programs is an extremely important method by which governments can probe public thinking and find out what people want. Borrowing a paradigm from science, government consists to a large extent of the conceiving and testing of theories - legislation is a kind of theory tested by social experiment. Historically, the borrowing of paradigms, or models, has sometimes been more confusing than useful, particularly when the paradigm has been misinterpreted. People have thought they were behaving "scientifically" when in fact they were not. In this instance, an inadequate acquaintance with scientific method might lead to the belief that scientific theories are arrived at inductively, by simple inference from a large number of observed facts - a kind of passive process. If people were to bring that naïve concept of theory making into their theory of democracy, they would tend to conceive the function of government as "inductive" - as feeling the pulse of public opinion and going the same way (public opinion leads and governments follow). What is intended here is rather to draw attention to the active element in theory making. Even supposedly "passive" observation has been shown by research in the psychology of perception to involve an active role of the mind – a constant forming and testing of hypotheses. At the everyday level the process is largely unconscious, but in modern physics it has become explicit, visible, and logically elaborate, and has been variously identified by the philosophers of science as the "postulational" component, the "hypothetico-deductive" method, and so on. A logicallyconnected theoretical structure is postulated, its consequences deduced, and the deductions then tested against experiment. Carrying this paradigm into the theory of government would lead us then to expect government to take a more active role. A government would discover the preferences of its citizens by the procedure "let us try this and see how people like it." For example, it would build an EXPO '67. Further, it would seek to solve the problem or problems of poverty, not simply by a naïve intuitive approach, nor simply by relying on the opinions of welfare recipients, but it would postulate theoretical models and test their correctness by experimental projects and programs.

Actually, many modern governments do act this way at times. They often try to steer a middle ground, by launching trial balloons - white papers and such - before committing a full experiment. Also, governments are not the only agents making postulates, or social proposals, at least at the conceptual stage and even sometimes in practice: governments can to some extent let intellectuals, and policy advisory councils, make proposals, and see whether or not they grab the popular mind; and they can observe privately-sponsored social experiments. Nevertheless, given the general lack of imagination, the apathy, and lack of interest on the part of the general public in making "thought experiments" - a general short-range pragmatism there is no substitute for the real experiment. In other terms this might be spoken of as *leadership*, followed by *accountability*. An essential feature of the approach, often overlooked, is objective evaluation of the experiment. The dyed-in-the-wool bureaucrat may tend to forget that the initial establishment was to be a trial only, or he may not see it to his own interest to terminate a failing program. Here external uncompromised review bodies can again be useful.

Satisficing. Does each program chosen have to be the best of all possible programs? If it were so, decision making would take forever. In fact, as Herbert Simon has pointed out, decision H. A. Simon, Models makers dealing with complex situations do not "optimize" or "maximize," they "satisfice," that is, they search for solutions until they find one that is good enough. For one thing, they recognize consciously or unconsciously that there are costs associated with the delay and with the search for further information. Thus they cut off further search at a point where the likelihood of finding a better solution, of sufficiently lower cost to justify the risk of further search, seems to balance the costs of the solution at hand. Or, put another way, they may search only until they find a solution that meets certain criteria. If alternatives are particularly difficult to find, the criteria tend to be set and raised or lowered according to the expectations that they can be met. In the field of goals, and the setting of priorities, the application of this principle takes the form that governments do not demand of a course of action that it advance toward all goals in some

of Man, Wiley, New York, 1957.

optimized fashion, according to a precisely ordered set of priorities, but only that it make a good enough improvement toward this or that goal or set of goals; or that it offer a good enough solution to a particular social or economic problem; and that it seem to offer a better contribution than other proposals at hand. For this type of decision making, a list of goals may be useful for reference, but it is not necessary in practice that the goals be carefully ranked in order of priority. Some, indeed, may be grouped in a category of higher urgency or importance than others, but that is a much weaker requirement. Particular proposals from a particular agency, or from a policy advisory body, often need to satisfy only a still weaker requirement, i.e., "this is an action for which the expected benefits outweigh the costs."

Iterative cycling is a method of approaching a best solution by successive approximations. It contains an element of the postulational approach, of trial and error, and of the offer and counter-offer techniques of bargaining. Thus it is used frequently in budget negotiations within government, and in practical politics. It is a feature of the PPB system as practised in the Canadian A. W. Johnson, "The Treasury Board of federal government. In relation to priorities for science and technology, it appears in one guise in the idea of an integrated "science budget" or "R & D budget." Intelligently used, this can be a device used by a coordinating science ministry to bring about an assessment of the relative value of research and development tember, 1971. in different areas related to goals and systems, under an assumption either of a constant (or slowly changing) supply of a scarce resource (scientists and engineers) or an assumption of a set proportion of total government expenditure to be allocated to innovation and risk. However, in line with the principles advanced earlier, that the choice of general operational goals (and expenditures) is not independent of technological opportunities, nor are expenditures on R & D independent of departmental missions and social goals, the procedure of a global "science budget" would at best make sense only if the final sum were a negotiated figure arrived at by iterative cycling. Even then its validity would hold only to the extent that one or both of the above assumptions regarding limited resources were true. It is used as an example here because it is an idea frequently advanced in the context of science policy, culminating in the use of a global expenditure as a goal of science policy. Here we would emphasize again an important distinction between using a global expenditure figure as an *indicator* of something, and construing it as a *goal*.

Grasping at straws. Perhaps a word should be said about one or two rather disreputable techniques, because they are in such widespread use. One can be seen in action when a committee, say a personnel selection board, is faced with a choice between two or more complex alternatives. The members of the committee are finding it difficult to weigh the various intangibles, one against the other. Finally, someone with a legalistic mind

Canada and the Machinery of Government of the 1970's", Canadian Journal of Political Science, Sepdiscovers an obscure requirement, laid down thirty years ago and now quite irrelevant, that happens to be satisfied by only one of the candidates. The committee, unanimously, heaves a sigh of relief to have the matter settled. Somewhat related is the school-of-fish phenomenon. Again it begins with a committee facing a difficult problem of evaluating intangibles, of negotiating and rationalizing. One member speaks up in a strong positive manner with a recommendation. Immediately the whole com- C. Northcote Parkinmittee lines up and points in the same direction, like a school of fish. Parkinson describes other methods of similar merit. Advisory councils and other external critics, while now and then suffering from such tendencies themselves, can, in general, exert a restraining influence.

Comprehensive planning. The treatment so far may have seemed to over-emphasize the incrementally-reacting, temporizing, short-term aspects of government's role. But governments, if they do their job as meta-systems, must take a holistic view, must plan ahead and must lead the way in social experiment. In keeping with the concepts developed in this study these functions must be performed with certain reservations, however. Comprehensiveness is not always necessary, nor necessarily better, nor always possible; the natural urge of the intellectual to put everything in good order must at times be resisted. Holism is to be resisted if it means uniformity; the proper implementation of the market-type mechancomprehensive view will often be to make sure that diversity is kept alive. A similar comment applies in the time dimension; the purpose of long-range planning will often be to make sure that future options are created or kept open. Planning need not always decree what shall be done; often it will consist in being prepared for the unlikely or the unexpected.

The observation that the world contains a large element of the unpredictable, chaotic, and unplanned, can lead either to the pessimistic conclusion that planning is therefore pointless, or to the optimistic conclusion that the way is open for planning to pay off. In a chaotic world, the person who knows where he wants to go has a considerable advantage. A business corporation, for example, may exploit a jumble of inconsistent government policies and conflicting jurisdictions into freedom to plan its own development. Thus, notwithstanding the various features of indeterminacy and diversity, a government should on the public behalf exercise its responsibility to take the lead in comprehensive planning.

The world must be handed over in good shape for evolution to those who come after us. The idea of the obligation to experiment is related; governments should help the society to keep adapting and evolving; the continual placing on trial of new options, new solutions, new ways of living, will cultivate the species diversity out of which we can hope that the best solutions will grow and spread through the society.

son, Parkinson's Law, Houghton Mifflin, Boston, 1957.

"Western economists are not prone to the fallacy of universal usefulness of comprehensive planning being well familiar with the advantages of market type modes of systems-management. Instead, many of them tend to the fallacy of universal usefulness of isms, supplemented by some aggregative economic policies, ignoring the very important cases in which comprehensive planning is preferable.'

-Dror, op.cit., p. 119.

The role of a Science Council is clear. It is to continually challenge the governments, and the society generally, with ideas, options, and opportunities growing out of science and technology. It should point out where diversity, and other values, are being destroyed, and options narrowed, by technology unwisely used. Against the tendency of governments to temporize from one election to the next (and MOSST, being a part of government will be forced to share that tendency), the Science Council must continue to emphasize the long-term view, to the point where short-sighted behaviour by a government is exposed as a sin, thus bringing the responsibility to anticipate the future into present consciousness. In another dimension the Council has the responsibility to push for the holistic or integrated view, against the tendency of governments, and other institutions, to fragment their approaches on jurisdictional lines. Narrow expediency, buckpassing, self-seeking, somnolence, and other bureaucratic, commercial, and political sins should be exposed by a policy council acting as a holistic, preferably divinely omniscient conscience.

VI. Conclusions

It is not easy to sum up the results of this exploration into the relationships between goals and science policy. The picture is considerably more complex than that implicit in the Science Council of Canada's Report No. 4. We have identified *individual goals, social system goals, government or meta-system goals, positive goals, avoidance goals, and areas of concern.*

Science policy does not originate from a single locus in the society, nor is it needed at only a single place or a single level. The picture we have been building portrays no Grand National Plan, no "coherent overall science policy," and no tidy tree of authority extending from the top down.

The structure of the society is not seen as primarily hierarchical, but more like a dynamic system of linked systems, throughout which authority, knowledge, and decision making are found to be distributed. Governance, or management, and policysetting are found in business corporations and other institutions and organizations as well as in governments. Goals and policies, some impinging from outside the country, compete and conflict at many levels, and must accommodate to each other, or seek arbitration. Coherence, such as there is, comes about through shared values, through the hierarchy of legal authority, through various power relationships, and through various meta-systems, whose mode of coordination or control is often through the communication of information and comprehension.

The systems and meta-systems exist in a matrix of public communication, the collective mind of the society, in which ideas are generated, circulate, achieve good currency, and die away again. If policies and decisions with respect to science and technology are to be both intelligent and democratic, a prerequisite is that the public discourse be well-informed. The analysis has tended to focus on the role of the Science Council of Canada in stimulating and rationalizing public discussion, but the Council can be regarded as simply an exemplar of many other agencies of all sizes in the society, extending to the individual scientist, engineer, or well-informed citizen. Thus we would emphasize the importance of the individual professional finding ways to contribute his or her expertise and values to the public debate, rather than regarding them as either irrelevant or as coopted by the goals of a particular organization in which he or she works.

As far as the federal government is concerned, such elements as come together into a science meta-policy are expected now to be brought to a focus in the Ministry of State for Science and Technology. This Ministry also should serve as the horizontal, coordinating agency, or meta-system, for the scientific activities within the government. It is regrettable but perhaps unavoidable that the goals of the Ministry will tend to take on the character of the political goals of the government in power, often emphasizing the short-term, incremental, and crisis-avoidance features.

The role of a quasi-independent policy advisory body such as the Science Council of Canada is more amorphous. Its influence is less direct but it can hope to have some effect at many levels in the society. Its goals will generally be long-range, and therefore may not always coincide with the expressed goals or priorities of the government - another reason why it may have to seek or postulate its own. Operating at different levels, the Council may not find itself with a single set of goals, but several. Rather than conceiving itself as having a fixed task, of designing an overall coherent science policy, the Science Council must conclude that science policy is not a thing, but an activity, and the closest it will ever get to designing a science policy based on national goals may be to carry on the activity described by Calder, "to bring experts and the public face to face in a _____Calder, op. cit. continuous dialogue about goals."

(italics added)

Appendices

Appendix A – A Definition of "System"

"A system is an integrated assembly of specialized parts acting together for a common purpose. The components of a system may be physical particles in an atom or electronic components in a computer; they may be biological cells in a plant or animal; they may be people in an organization or a society; they may also be specialized ideas and knowledge in a philosophical system. But whatever the components, an assembly of specialized parts or functions, acting cooperatively for a common purpose, is generic to the idea of any system.

"The pattern always is one of a group of entities, each having a specialized, essential function. But each is dependent for its system effectiveness upon its couplings to the system's other parts and the external world. Each entity of the system receives information or energy from its neighbors and from the system's environment; each entity processes this information or energy in its specialized way and sends its outputs to the rest of the system and to the external world.

We must think of every system as part of some larger system – as part of its environment – for only in its interactions with its environment are the system's input and outputs defined. For example, a computer must have access to its program, its data, and its user; an animal cannot be divorced from its food supply; a plant needs soil, water, and solar radiation; an industrial organization needs raw material, capital, and consumer markets – and must also have access to people and knowledge "markets"! The "identity" of a system – its purpose – is defined by its relations to its environment.

"When we think of a system, we must place equal emphasis on purpose, parts, and the communications links and couplings between the parts. Without parts, there is no system; with parts and no couplings between the parts, there is still no system; and with parts and no purpose, there is no coupling and no system! Specialized parts, couplings, and purpose are the three characteristics which define every system.

"The specialized parts of any system (and the system and its environment) are coupled together through an exchange of information or energy. The kinds of couplings for this exchange determine some of the essential characteristics of systems. In general, there are two major kinds of couplings. Each is characterized by its direction of flow between input and output. In a forward-acting couple or link, the output is determined by the input and the action, or function, of the specialized part; the flow of the "stuff" being processed is forward only, from input to output. But when part of the output of a system or component is used to modify its input or action, we have a feedback link, a feedback couple. The governor on a steam engine is a good example, or the automatic volume control on a radio, the oscillator in a radio transmitter, error detection and correction in a computer, or homeostasis in a living organism. A programmed computer is a

J. A. Morton, Organizing for Innovation, A Systems Approach to Technical Management, McGraw-Hill, New York, 1971.

good example of a forward-acting system with no feedback. So is a runaway automobile. Or an autocratic organization where output is rigidly determined by the inputs of the "programmer," sometimes known "affectionately" as The Boss. But when man and computer can interact, when the driver can regain control of the automobile, when the manager stops behaving like an autocrat, the total system becomes goal-seeking and error-correcting, perhaps even adaptive, because now there is feedback.

"I must distinguish between two kinds of feedback, positive and negative. Like reward and punishment, one enhances a change, the other diminishes it. Both can be useful and both can be detrimental. Their effect upon system behavior – good or bad – depends upon the purpose, or lack thereof, with which each is employed.

"Negative feedback occurs when a change in input or action of the system is opposed by the output fed back. Such feedback produces a trend toward equilibrium and stability. Negative feedback is the basis of automatic control systems, such as in speed-control governors or automatic volume control. It is also used to reduce the noise and distortion in electronic amplifiers. Without negative feedback, long-distance radio and telephone would be impossible. Without it, biological organisms could not exist in changing environments, for they would lack the feature of homeostasis. But since negative feedback opposes change, it can also have its bad effects. Like all punishment and no reward, too much negative feedback produces a rigid system with no gain or amplification; it can inhibit creative change in human beings and institutions.

"Positive feedback occurs when a change in input or action of the system is enhanced by the output fed back. This kind of feedback produces exponential growth; unchecked, it produces instability Applied with discretion, it is the basis of useful electric oscillators, lasers, and nuclear piles. As intelligent reward, it can enhance a desired change in human behavior.

"But like negative feedback, it too can have disastrous effects when applied without purpose or limit. In an oscillator or nuclear reactor, unlimited positive feedback will destroy the system and perhaps its environment. Explosions, epidemics, and the wild growth of biological populations are examples of the disastrous effects of undisciplined positive feedback. The compulsive behaviour of psychotics and mobs is another case, all stimuli being interpreted as reinforcement for the perturbation in behaviour. As we say in telephone jargon: "The system sings by itself."

Appendix B – System Dynamics, or the Use of the Computer in Modelling Social Systems

"In system dynamics, a growing body of theory about the structure of multiloop feedback systems guides the organization of details into the relevant structure. The resulting structures are too complex for the mind to manage, so computer models are used to examine the implications of the assumptions that have been taken from our mental models. By this process, we begin to see the future consequences of present assumptions and actions. We also begin to see how action in one part of a social system can produce unexpected results in some very different dimension.

"The concepts underlying system dynamics have evolved over the last hundred years. They apply to all systems that change through time, whether those systems are found in science, engineering, management, economics, politics, ethics, or combinations of the foregoing. Because the systems in science and technology are simpler than those in society, the methods were first developed in and applied to the technological areas. But now the power of the method has grown to match the complexity of social systems."

[A strong claim. Forrester's usual and more modest argument is that human thinking about complex social systems is better when aided by computers than when unaided.]

"The system-dynamics approach starts with the perceived causeand-effect relationships taken from our mental models. In their totality, mental models contain far richer detail than has ever been reduced to writing. In turn, the written literature is far richer in concepts than the quantitative and statistical literature. All information sources are used, in computer-model construction, to the extent that the sources contain effective inputs. But, of the available inputs, the mental models held by a group of perceptive individuals are usually the most nearly complete, diverse, and sensitive to the localized causal forces in a society."

[The references to "cause-and-effect relationships" and "causal forces" here should not be misconstrued. Most of our "mental models" based on observation of human behaviour are at most *probabilistically* causal, expressed in statements of the form "in such circumstances most people would do such-and-such" or "holding such beliefs (or goals, or aspirations) he or she would likely decide thus." Whether or not Forrester himself falls into the determinism trap, his language here certainly entices others to do so.]

"With rare and important exceptions, most of the written literature has already been filtered by an author through a nondynamic framework of perceptions so that the essential structure of dynamic behaviour has been lost."

[In this statement Forrester recognizes the role of basic paradigms in distorting people's perception of the world, a problem that Beer

drawn from Jay W. Forrester, "Churches at the Transition Between Growth and World Equilibrium," Zygon, Journal of Religion and Science, vol. 7, no. 3, 1972.
also draws attention to (see Appendix C). Indeed, as explained in the text of Chapter III, this "blinding" effect of certain traditional paradigms is one important reason for introducing the use of "systems" language in this study.]

"The localized cause-and-effect relationships describing the separate parts of a social system are selected and interconnected according to the principles of structure derived from the science of feedback systems. The result is a computer model that replicates the structure and assumptions taken from the mental models now being used for running our society. In the process, the assumptions become more explicit and better organized.

"The resulting computer model then shows, without doubt (sic), the dynamic consequences through time of the assumptions stated in the model. Often the consequences are unexpected. The computer model reveals the inconsistencies and contradictions that exist within the common mental models. Computer simulation shows how the fundamental assumptions that are accepted do not lead to the consequences that people presume."

"A system-dynamics computer model can accept any concept that can be explicitly stated in our normal written language. Such a model unifies diverse disciplines by integrating ethical, psychological, legal, geographical, technical, sociological, and economic aspects of a social system. The procedure is no more mechanistic and impersonal than any reduction of concepts to precise description. The procedure can deal with human and moral assertions, if precisely stated, as well as with the physical aspects of our existence."

[The procedure therefore promises to be capable of building into the models of social behaviour the effects of the values, goals and aspirations held by the human participants – and, indeed, the effects of different ideologies, different perceptions of reality, etc. However, while all of this should be feasible *in principle*, optimism should be tempered with a grain of caution. Perhaps the most cogent criticism of Forrester's writings is that, in his enthusiasm for his method and in his desire to see people start to work with it and improve it, he tends to raise people's expectations too high too soon. At the present stage, the benefits to the modellers of making the attempt tend to outweigh the value of any substantive outputs.]

"One should address problems in a social system by first identifying the fundamental causes and then moving on to design revised policies for alleviating the problems. One should never attempt merely to find a solution without first establishing the dynamic causes. Such a results-directed beginning is likely to lead to the treatment of symptoms without benefit. For example, the nation has acted on its urban crisis during the last several decades without focusing on the causes of urban stagnation and decay. Instead, government has sequentially attempted to relieve symptoms as they arose. Congested traffic led to more highways, the central city became more crowded, parking garages were built, more people entered the city, buildings became taller, traffic continued to increase, and crowding and social dislocation worsened. All of these actions were taken without facing the questions of proper city size, desirable population density, and how to control both so that the other symptoms of overloading would not arise. Instead of first trying to relieve social system pressures, an analysis should begin by establishing a model of the structure and relationships that interact to produce the problems. That is, one should start by replicating the system that generates the symptoms. Only then can one be confident that he is beginning to understand the underlying causes.

"Surprising as it seems, the difficulties in our social systems are caused by the interplay of elements that individually are well known and highly visible. Our social troubles do not come from hidden causes or capricious behavior. Instead, they come from evident policies that are not recognized for either their true importance or the dynamics of their interaction.

"It was first in our studies of corporations that we realized how well-known policies could interact to give puzzling consequences. Time after time, we had the experience of going into a corporation with conspicuous and widely reported symptoms of trouble. The symptoms might include low profitability, falling market share, or high fluctuations in employment. Such symptoms are well known both inside the corporation and out. In searching for the relevant structure and policies, one discusses with people their actions and their responses to pressures. In general, we found that people are clear and articulate about what they are doing. Investigation usually verifies that they are doing as they say. Furthermore, the actions in general are motivated by a sincere intention to solve the organizational difficulties. Then, with due regard for the principles of feedback structure, we have assembled into a computer-simulation model those relationships, policies, decision processes, and interactions that have been described by the participants. The computer-simulation model usually shows that the known structure and policies interact to create the observed troubles. In other words, the very actions people know they are taking in an effort to solve major difficulties are in fact producing those difficulties. A destructive spiral can easily develop. A problem appears. The "solution" is considered obvious and action is taken. By obscure dynamics within the complex social system, the "solution" makes the problem worse. However, because the deterioration is blamed on outside influences, the "solution" is applied with ever more vigor, and the situation is caused to deteriorate still further."

"A social system, if it is to fulfill human needs, must meet a multiplicity of goals. These goals can conflict with one another in several dimensions – in current trade-offs, in time, and in hierarchy. Furthermore, the nature of the most important goal conflicts can change, depending on the mode in which the system is operating.

"Conflict between Coexisting Goals. Goals can conflict in current trade-offs. That is many goals exist simultaneously in different parts of a system. Efforts to reach one goal may mean that another is put further beyond reach. We simultaneously have goals for food, clean air, material goods, peace, sense of mission, elimination of current stresses, and confidence in the future. These objectives are coupled in various ways. Actions toward one goal may produce quite unexpected responses and deterioration in other system objectives. For example, efforts to improve the economic and technological aspects of cities attract population. Population densities rise until the economic and technological improvements are compensated by rising psychological tensions, crime, drug addiction, despair, and social disorganization. We know how to work toward economic and technical goals. But such effort shifts the system pressures into the more intangible sectors with which we cannot cope.

"Conflict between Present and Future. A second goal conflict exists in time – between the present and the future. Actions to enhance the present generally deteriorate the future. Examples are all about us to illustrate how actions that favor the present can undermine the future. If one has an urgent report to finish, he can accomplish the most in the next twenty-four hours by working through the night, but the price is paid in low effectiveness during the next two days. Or, if one wishes to improve his material living in the short run, he has only to borrow money, use his credit cards, and live beyond his means. But in the long run, the price must be paid. If the debts are to be met, the standard of living must fall below one's average income. Likewise, the corporation can improve short-term profitability by postponing expenditures on new-product research and on the repair of equipment. But, in time, the quality of products suffers, the efficiency of production declines, and profits drop lower than at the start."

"Conflict between Subgoals and System Goals. A third goal conflict exists in hierarchy – between the goals of subsystems and the goals appropriate to the total system. For example, maximum wages to individual workers is in conflict with profitability of the business. Or, the minimum-cost goal of the business leads to excessive generation of pollution, with the price paid by the larger public in a poorer environment.

"Attempting to enhance each subgoal of a social system does not assure the best possible outcome for the system as a whole. In fact, efforts to improve each of the components of a system can lead to far less than the best possible total results."

"Social systems tend to decay as a result of collapse in their longterm-goal structures. As the enduring values erode, emphasis shifts to short-term objectives. As the present is emphasized over the future, the result is long-term deterioration and further emphasis on the short run . . . All of our social systems are subject to the erosion of longterm goals, unless some effective institutional mechanism exists for sustaining a vision of the future and subordinating short-term conflicting goals."

"If the long-term values are persuasive and if there is an institutional structure to project them into day-by-day decision making, then the long-term values are influential."

[Forrester goes on to identify the religious institutions as the custodians and promoters of these long-term values. Thus, in our

terminology, we might characterize religious institutions as *meta-systems* that coordinate decisions in many separate social systems, through the medium of a common set of beliefs and values.]

"Without the long-term values, 'living for the present', if carried to an extreme, makes the future impossible."

"Science, law, economics, . . . psychology [and religion] are also in compartments as if each could exist in its own subworld. But our studies of systems show that important behavior modes and serious troubles arise because of interaction among the subsystems. Human existence will not be understood or safely managed if each compartment is treated separately."

Appendix C – Toward the Definition of Meta-System

Since the concept of meta-system will be found useful throughout this study, an attempt at a more exact definition seems worthwhile.

A meta-system is a higher order system, influencing, coordinating, or controlling the actions of other systems. Several types might be identified, according to their modes of influence, which range all the way from the persuasive power of ideas, information, or values, to direct legal authority. A large corporation is a meta-system with respect to its subsidiary companies. A federal government is a metasystem relative to its provincial or state governments. The mind of the human being is a meta-system that coordinates the activities of the many more-or-less self-regulating systems or subsystems that make up the human body. In general the meta-system devotes its attention to problems that are beyond the capability of the individual systems to solve – because of lack of perspective, conflict of interest, and such.

Implicit in the concept of *system* is the concept of feedback, of information flow by which mutual adjustment between systems and between systems and their environment is achieved. That is to say, the system of the rigid bureaucracy, in which information and authority flow only one way, from the top down, is an extreme limiting case. In practice, it is unworkable except in extremely special circumstances, because it assumes that all information and knowledge reside at the top, and none in the subsidiary systems. Those cases where absolute authority seems to be successful will be those in which the system is small enough for one person to know everything that needs to be known. This rapidly becomes unfeasible as systems grow in size and complexity.

The nature of the authority of the meta-system over its member systems needs to be carefully understood, because our conventional paradigm or model of bureaucratic organization, the administrative tree, is so inadequate as to lead to serious misconceptions of the ways that real organizations work, misconceptions of what can be expected of them, and misinterpretations of what they try to do. We seek also a concept of meta-system that exists because it is needed by its members, not an authority-structure that exists because certain individuals are carried away by lust for power and prestige. This does not mean that individuals in meta-system positions will not be rewarded by feelings of power and prestige, but only that such rewards will be part of a bargain, a return for services rendered rather than a distortion or usurpation of the meta-system to private ends. A fair model (if not carried too far) is a biological one. Without the meta-control, the brain, formulating meta-policy and making meta-decisions, the organism as a whole would not survive, and without the survival of the total organism the subsystems would not survive either. Nature accomplishes this with a minimum of detailed authority, presumably designing its organizations along principles of maximum efficiency and economy. The brain does not need to concern itself with the details of breathing, digestion, heartbeat, or kidney function, yet there are

adequate messengers of malfunction, and there is sufficient overriding control to cope with emergencies and to guide the total organism.

In the healthy organism, the best interests of the whole generally coincide with the best condition of its parts. When this is not the case, the organism is internally at odds with itself, and the meta-system negotiates a second-best compromise.

"Subsidiary companies of a large corporation cannot be allowed to operate with wholesale autonomy in defiance of each other: therefore we think of them as subservient to the meta-system called the corporation. The same is true for departments of state, which are therefore subservient to their meta-system, the state itself. The father may intervene in a dispute between his subservient children. Using the higher centres of my brain, I may make an act of conation which overrides my subservient autonomic system – by holding my breath, for example.

"[But] these precedents are misleading, because they appear to achieve meta-control by virtue of superior authority rather than by logical necessity. That is to say, we do not see them as metasystems in the proper sense, where they are supposed to employ a higher-order language in order to resolve systemic problems posed in local languages. Instead, we map them onto our hierarchic models of authority. . . .

"In fact, the corporation and the state, like the father, should be cybernetically regarded as servants of the subsidiary companies. the departments and the children. The realities of life are found at the operational level. If my brain sets out to kill my body by holding its breath for good, the autonomic nervous system will soon thwart that merry design. Equally the children and the subsidiary organizations will thwart authoritarian behaviour at exactly the point where the meta-system is apparently acting from authority rather than from superior information and higher-order logic. This revolt is easily brought about, because the meta-system does not deploy sufficient variety to hold the lower systems down. If it wishes to turn itself into a genuine supra-authority rather than a meta-system, that is easily done as well – by destroying variety in the subservient system. In this way my brain can kill my body by throwing it over a cliff, fathers and company presidents may become despotic, and the state may become totalitarian.

"By confusing meta-systems with supra-authorities we have almost lost the chance of understanding what to do. . . ."

"there is plenty of evidence to suggest that to use a meta-system as a supra-authority whereby to ride roughshod over the interests of minorities is \ldots inoperable. Such a machine is self-defeating \ldots in the long run – and moreover the cybernetician would not expect it to work in the short run – for one simple reason: informational overload. We may invest all power in a super-supraauthority, but it cannot exercise that power effectively in the very nature of cybernetic law. When we are talking about these large problems, there are not enough channels in the world to convey information, nor enough computers in the world to ensure requisite variety.

"The fresh design of a meta-system, exerting meta-controls, is the *only* solution to our problems. The problem is for cybernetics to discover, and to make abundantly clear to the world, what meta-systems truly are, and why they should not be equated with the supra-authorities to which our organizational paradigms direct them. . . .

"The whole point about a meta-system is that it uses a metalanguage, and the whole point of a meta-language is to be competent to decide propositions which are undecidable in the lower order languages of the systems concerned."*

Thus, in this concept, the meta-system has its meta-level of working. It does not do over again the work of each of its component systems, not does it operate on an equal "democratic" footing; it stands in some sense *above* or *aside*. Yet at the same time it is as much servant as master – it is authoritarian to the extent the lower systems need it to be. Thus it might be said that more strictly we are attempting to define "democratic meta-system". For the democratic society the biological model is not quite right – unless we can identify some equivalent of the central brain, some coherent collective consciousness and will, a societal "soul". Without that, the "democratic meta-system" must differ in an important way from the biological model, and we must be wary of being led astray. The point is open to further debate, admittedly, in that some philosophers, while quite prepared to attribute meaning to the concept, would challenge us to locate in the human body just where *its* "soul" is to be found.

*Stafford Beer, "The Liberty Machine", Futures, December 1971, p. 345-346.

Appendix D – National Goals

National Goals (Science Council Reports No. 4 and No. 9)

- 1. National Prosperity
- 2. Health
- 3. Education
- 4. Freedom, Security, Unity
- 5. Leisure and Personal Development
- 6. World Peace
- 7. High Quality Environment

Science Council of Canada Report No. 4, Towards a National Science Policy for Canada, Queen's Printer, Ottawa, 1968.

Science Council of Canada Report No. 9, This Land is Their Land ..., A Report on Fisheries and Wildlife Research in Canada, Queen's Printer, Ottawa, 1970.

National Goals (President's Committee – Eisenhower)

- A. Status of the Individual: enhancing personal dignity, promoting maximum development of capabilities, widening the opportunities of individual choice.
- B. Individual Equality: eliminating discrimination on grounds of race, sex, religion, etc.
- C. Democratic Process: improving the quality of public administration at all levels, increasing the collaboration and sharing of power among the various levels of government, improving the professionalism of state legislatures and local bodies.
- D. *Education*: extending the quantity and improving the quality of education at all levels.
- E. Arts and Sciences: extending the frontiers of theoretical and applied knowledge, cultivation of the Arts.
- F. *Democratic Economy*: maintenance of competition and economic decentralization.
- G. *Economic Growth*: increasing both the quantity and quality of growth, including capital investment in the public sector, maintaining full employment and improving the standard of living. Fostering of productive innovation. Providing education for a more capable and flexible work force.
- H. *Technological Change*: increasing the application of new technologies while guarding the economic security of the work force.
 - I. Agriculture: improving the well-being of the agricultural sector of our economy
- J. Living Conditions: reversing the "decay" of the cities. Assuring the orderly growth of urban complexes and the availability of environmental amenities.
- K. *Health and Welfare*: improving the quality and quantity of medical and welfare services. Reducing juvenile delinquency and family breakdown.

United States, President's Commission on National Goals, Goals for Americans, Prentice-Hall, Englewood Cliffs, New Jersey, 1960.

Categories of Social Need

- I. Health
- II. Social Mobility
 - (1) Economic opportunity
 - (2) Educational opportunity
- III. Physical Environment
- IV. Income and Poverty
- V. Public Order and Safety (i.e., physical security)
- VI. Learning in Science and Art
- VII. Participation and Alienation
 - (1) Freedom
 - (2) Equality and justice
 - (3) Family status
 - (4) Social integration/alienation

United States, Mancour Olsen, Toward a Social Report, Department of Health, Education and Welfare, January 1969.

Socially Actionable Consensus Happiness Requisites

- 1. Health
- 2. Property and economic well-being
- 3. Personal status/security
- 4. Personal development/education and training
- 5. Personal freedom and individual opportunity
- 6. Political freedom and good government
- 7. Equality
- 8. Leisure
- 9. Privacy
- 10. Pleasing or aesthetic surroundings

N. Rescher, On Quality of Life and the Pursuit of Happiness, RAND P-4224, October 1969.

The Values of Civilization (Sir Kenneth Clarke)

Order	rather than	Chaos
Creation	,,	Destruction
Gentleness	**	Violence
Forgiveness	**	Vendetta
Knowledge	"	Ignorance
Human sympathy	>>	Ideology
Courtesy	**	Selfishness
Eco-consciousness	,,	Compartmentation, narrowness, or specialization
Respect and toleration for genius	,,	Anti-intellectualism, egalitarianism

Palme's Priorities

Sweden Now asked the then Prime Minister Olof Palme which measures he considers most important in moving toward greater equality. In his personal answer, as given to Ruth Link, he mentions a number of important issues:

An active industrial policy to safeguard full employment and to further industrial expansion.

Great improvement of the working environment.

Abolishing of differences in social treatment between white and blue collar employees.

Extension of industrial democracy.

Improvement of environment and pollution-control.

Better planning of land resources and measures against land speculation.

Diminishing of income differences, primarily by helping low-income groups.

Greater equality for women, and consequently liberation of men.

Improvement of housing by continued production, and of housing environment by better services and no income or other segregation.

Pre-schooling for all.

Expansion of general education, coupled with closer contact between education and the labor market.

Decentralization of higher education.

Decentralization of cultural services and efforts to activate people culturally.

Expansion of adult education to equalize opportunities for elder generations.

Extension of labor market services to help people obtain better jobs. Improved benefits and broadened activities for old people.

Dental health insurance.

Reforms for the handicapped and other special groups.

Expansion of health services, particularly out-patient care.

For regional balance, improved employment opportunities and services in certain areas.

Promoting equality before the law by helping people to use their legal rights.

Amending family laws in accordance with our existing values.

To provide consumer protection and promote consumer influence.

Internationally, to increase aid to at least one percent of the GNP.

Publications of the Science Council of Canada

Annual Reports

First Annual Report, 1966-67 (SS1-1967) Second Annual Report, 1967-68 (SS1-1968) Third Annual Report, 1968-69 (SS1-1969) Fourth Annual Report, 1969-70 (SS1-1970) Fifth Annual Report, 1970-71 (SS1-1971) Sixth Annual Report, 1971-72 (SS1-1972) Seventh Annual Report, 1972-73 (SS1-1973) Eighth Annual Report, 1973-74 (SS1-1974) Ninth Annual Report, 1974-75 (SS1-1975) Tenth Annual Report, 1975-76 (SS1-1976)

Reports

- *Report No. 1,* A Space Program for Canada, July 1967 (SS22-1967/1, \$0.75)
- Report No. 2, The Proposal for an Intense Neutron Generator: Initial Assessment and Recommendation, December 1967 (SS22-1967/2, \$0.25)
- Report No. 3, A Major Program of Water Resources Research in Canada, September 1968 (SS22-1968/3, \$0.75)
- Report No. 4, Towards a National Science Policy in Canada, October 1968 (SS22-1968/4, \$0.75)
- Report No. 5, University Research and the Federal Government, September 1969 (SS22-1969/5, \$0.75)
- Report No. 6, A Policy for Scientific and Technical Information Dissemination, September 1969 (SS22-1969/6, \$0.75)
- Report No. 7, Earth Sciences Serving the Nation Recommendations, April 1970 (SS22-1970/7, \$0.75)
- Report No. 8, Seeing the Forest and the Trees, 1970 (SS22-1970/8, \$0.75)
- *Report No. 9,* This Land is Their Land . . ., 1970 (SS22-1970/9, \$0.75)
- *Report No. 10,* Canada, Science and the Oceans, 1970 (SS22-1970/10, \$0.75)
- Report No. 11, A Canadian STOL Air Transport System A Major Program, December 1970 (SS22-1970/11, \$0.75)
- Report No. 12, Two Blades of Grass: The Challenge Facing Agriculture, March 1971 (SS22-1970/12, \$0.75)
- Report No. 13, A Canadian STOL Air Transport System A Major Phase I of a Major Program on Computers, August 1971 (SS22-1971/13, \$0.75)
- Report No. 14, Cities for Tomorrow: Some Applications of Science and Technology to Urban Development, September 1971 (SS22-1971/14, \$0.75)
- Report No. 15, Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing, October 1971 (SS22-1971/15, \$0.75)

- Report No. 16, It is Not Too Late Yet: A look at some pollution problems in Canada . . . , June 1972 (SS22-1972/16, \$1.00)
- Report No. 17, Lifelines: Some Policies for a Basic Biology in Canada, August 1972 (SS22-1972/17, \$1.00)

Report No. 18, Policy Objectives for Basic Research in Canada, September 1972 (SS22-1972/18, \$1.00)

- Report No. 19, Natural Resource Policy Issues in Canada, January 1973 (SS22-1973/19, \$1.25)
- Report No. 20, Canada, Science and International Affairs, April 1973 (SS22-1973/20, \$1.25)
- Report No. 21, Strategies of Development for the Canadian Computer Industry, September 1973 (SS22-1973/21, \$1.50)
- *Report No. 22,* Science for Health Services, October 1974 (SS22-1974/22, \$2.00)
- Report No. 23, Canada's Energy Opportunities, March 1975 (SS22-1975/23, Canada: \$2.75, other countries: \$3.30)

Report No. 24, Technology Transfer: Government Laboratories to Manufacturing Industry, December 1975 (SS22-1975/ 24, Canada: \$1.00, other countries: \$1.20)

Report No. 25, Population, Technology and Resources, July 1976 (SS22-1976/25, Canada: \$2.00, other countries: \$2.40)

Background Studies

- Background Study No. 1, Upper Atmosphere and Space Programs in Canada, by J.H. Chapman, P.A. Forsyth, P.A. Lapp, G.N. Patterson, February 1967 (SS21-1/1, \$2.50)
- Background Study No. 2, **Physics in Canada: Survey and Outlook,** by a Study Group of the Canadian Association of Physicists, headed by D.C. Rose, May 1967 (SS21-1/2, \$2.50)
- Background Study No. 3, Psychology in Canada, by M.H. Appley and Jean Rickwood, September 1967 (SS21-1/3, \$2.50)
- Background Study No. 4, The Proposal for an Intense Neutron Generator: Scientific and Economic Evaluation, by a Committee of the Science Council of Canada, December 1967 (SS21-1/4, \$2.00)
- Background Study No. 5, Water Resources Research in Canada, by J.P. Bruce and D.E.L. Maasland, July 1968 (SS21-1/5, \$2.50)
- Background Study No. 6, Background Studies in Science Policy: Projections of R & D Manpower and Expenditure, by R.W. Jackson, D.W. Henderson and B. Leung, 1969 (SS21-1/6, \$1.25)
- Background Study No. 7, The Role of the Federal Government in Support of Research in Canadian Universities, by John B. Macdonald, L.P. Dugal, J.S.

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	7. \$1.00)
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	Survey of Research and Development in
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	Institute of Canada, 1969 ($SS21-1/9$, $S2.50$)
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	portation R & D, by C.B. Lewis, May 1971 (SS21-1/17, \$0.75)
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Background Study No. 28,	Education and Jobs: Career patterns among selected Canadian science graduates with in- ternational comparisons, by A.D. Boyd and A.C. Gross, June 1973 (SS21-1/28, \$2.25)
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Background Study No. 30,	A Technology Assessment System: A Case Study of East Coast Offshore Petroleum Exploration, by M. Gibbons and R. Voyer, March 1974 (SS21-1/30, \$2.00)
Background Study No. 31,	Knowledge, Power and Public Policy, by Peter Aucoin and Richard French, Novem- ber 1974 (SS21-1/31, \$2.00)

- Background Study No. 32, Technology Transfer in Construction, by A.D. Boyd and A.H. Wilson, January 1975 (SS21-1/32, \$3.50)
- Background Study No. 33, Energy Conservation, by F.H. Knelman, July 1975 (SS21-1/33, Canada: \$1.75, other countries: \$2.10)
- Background Study No. 34, Northern Development and Technology Assessment Systems: A study of petroleum development programs in the Mackenzie Delta-Beaufort Sea Region and the Arctic Islands, by Robert F. Keith, David W. Fischer, Colin E. De'Ath, Edward J. Farkas, George R. Francis, and Sally C. Lerner, January 1976 (SS21-1/34, Canada: \$3.75, other countries: \$4.50)
- Background Study No. 35, The Role and Function of Government Laboratories and the Transfer of Technology to the Manufacturing Sector, by A.J. Cordell and J.M. Gilmour, April 1976 (SS21-1/35, Canada: \$6.50, other countries: \$7.80)
- Background Study No. 36, The Political Economy of Northern Development, by K.J. Rea, April 1976 (SS21-1/36, Canada: \$4.00, other countries: \$4.80)
- Background Study No. 37, Mathematical Sciences in Canada, by Klaus P. Beltzner, A. John Coleman, and Gordon D. Edwards, July 1976 (SS21-1/37, Canada: \$6.50, other countries: \$7.80)
- Background Study No. 38, Human Goals and Science Policy, by R.W. Jackson, October 1976 (SS21-1/38, Canada: \$4.00, other countries: \$4.80)

Issues in Canadian Science Policy

Issues 1, September 1974 (SS21-2/1, \$1.00) Issues 2, February 1976 (SS21-2/2, Canada: \$1.00, other countries: \$1.20) Issues 3, June 1976 (SS21-2/3, Canada: \$1.00, other countries: \$1.20)

Perceptions

Vol. 1, Population Growth and Urban Problems, by Frank Kelly, November 1975 (SS21-3/1, Canada: \$1.25, other countries: \$1.50) Vol. 2, Implications of the Changing Age Structure of the Canadian Population, by Lewis Auerbach and Andrea Gerber, July 1976 (SS21-3/2, Canada: \$3.25, other countries: \$3.90)

Occasional Publications

A National Statement by the Schools of Forestry at Canadian Universities, October 1973

A National Statement by the Faculties of Agriculture and Veterinary Medicine at Canadian Universities, 1975

Tomorrow's Biology?: A National Statement on Basic Biology in Canadian Universities, 1976