A SCENARIO GENERATOR FOR PUBLIC POLICY AND PROGRAM IMPLEMENTATION

by

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(ABSTRACT)

Public policy and program implementation has come to be regarded as a significant problem area in the governance process. Research has provided insights but falls short of totally satisfactory prescriptions for operational success. The literature on policy and program implementation reflects a dichotomy of means between centralized control and delegation of substantial discretionary authority. The resulting theory leaves a gap with practice. Scenario writing is one of the techniques available to practitioners that might be employed to assist in the execution of their responsibilities. Scenarios can be useful tools, but their preparation is costly and time consuming. It was hypothesized that computer modeling techniques and artificial intelligence could be applied to scenario generation to create an effective, practical instrument to permit wider and more effective use of scenarios for planning and management. A computer supported procedure is presented for generating scenarios which describe alternative sequences of future events for a given

situation and proposed policy. The generator design reflects a three-way compromise between processing flexibility, data-base structure, and user workload requirements. This prototype generator was subjected to exploratory trials. The lessons learned highlight some potentially valuable program improvements, the importance of focusing the scenario at a level useful to the reader, and the need for a common set of definitions.

DEDICATION

Mary Ellen, John, Elisabeth

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The writing of the doctoral dissertation is reputed to be a solitary endeavor, but the experience of this case has demonstrated that the contrary is closer to the truth. Without the interest and support of a number of sympathetic and supportive people, this effort would never have been brought to any conclusion. First is Professor John Dickey who suggested the topic, and who provided invaluable advice as the project progressed. Next is Professor Jim Wolf who never lost faith and was there to provide the needed impetus when I felt like the latest addition to the La Brea Tar Pits. To Professors John Rohr and Richard Nance go my heartfelt thanks for their insightful comments and suggestion. Finally, thanks to Ms. Carla Pittmann, Dr. Raymon R. Bruce, and Mr. Donald C. Eberly who cheerfully endured innumerable meetings and interminable discussions.

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CHAPTER 1

INTRODUCTION

> Analysis is honored, evaluation is entrenched, all without a word of exhortation or, may I observe, indignation about the lack of implementation.[1]

If politics, as Bismarck is alleged to have said, is the art of the possible, then administration must be the art of the practical. Just what is possible and practical is a function not only of the pluralist sociopolitical system we enjoy but also of the parallel complexities of the practical problems we face. Policy implementers, at all levels, are trapped by increasing issue complexity, multiple power centers, constantly increasing expectations, and finite, if not decreasing, resources. Practitioners would benefit from a tool to help deal with these complexities.

This dissertation draws upon three areas: studies of policy implementation, research into simulation and scenario building, and work on computer modeling and artificial intelligence. The objective of this effort is to develop a prototype instrument, in the form of a computer program, to assist policy advocates in the planning and execution of policy implementation, and to explore the application of that instrument against specific domains.

THE PROBLEM

The Constitution institutionalizes conflict from the top and new interest groups seem to emerge continuously from the bottom. Expectations of constituents grow, and novel demands for government attention are put forth. New programs emerge and old ones evolve, adding additional complexity to the landscape that must be travelled. Resources remain limited, and the time available seems to diminish. Policy implementers are forced toward a trap as increasing issue complexity, multiplying stakeholders, and limited or declining resources combine with the inadequate theory and the implementer's limitations (cognitive and otherwise) to frustrate the governance process. Policies, once officially adopted, are subject to continued opposition, manipulation toward other goals, and resistance in the implementation phase.

Although the Constitution has enshrined conflict, the future environment may be expected to present implementers with increasing challenges. New and modified public programs must be tailored to fit already complex environments cluttered with existing programs, some of which may be changing as well. Administrators must consider larger and even more diverse sets of information and uncertainties while constrained by the limits of human rationality. Further,

> We focus on the actual making of policy rather than on the factors that influence it because the number of factors that make themselves felt in policymaking is almost limitless, and most models either omit many of these factors or obscure the fact that those factors they do emphasize are more influential in some aspects of policymaking than in others.[2]

Part of the problem lies inside the administrative institutions and part outside. Attempts by theoreticians to describe the implementation process and to prescribe remedies for problems have generated a continuing debate which, for all its heat, sheds only partial light on the difficulties faced by practicing administrators. The resulting conflicts in the theory may not be the most egregious for public administration, but it cannot help but undermine practitioner confidence. Contrary to the view that " ... the discipline of public administration is plagued by a weak or absent core," practitioners have to harmonize multiple theories.[3]

The difficulties presented by the theoretical literature, and others which will be explored in the next chapter, will necessitate some choices of assumptions which will affect the instrument's design and application. Further, we will have to deal with tradeoffs in selection of a level of analysis, a time frame, and model structure and process. This effort is intended to point the way toward some reduction in the risk of failure, delay, or diversion which may confront policy implementors.

HYPOTHESIS

The argument for a scenario generator goes as follows. The process of policy/program implementation can be characterized as a series of multi-actor interactive processes. These processes can be modeled as a network of loosely coupled games. To implement a policy successfully means to achieve certain outcomes from these processes. The achievement of these outcomes can be simulated, in a computer program, as winning the right sequence of games. A description of the events comprising these processes can constitute a scenario. A scenario which leads to successful policy/program implementation contains a strategy.

The central question is: can artificial intelligence and computer modeling capabilities be applied to scenario building to improve on the limits of intuition, experience, and training to assist practitioners in planning and executing strategies for policy/program implementation?

METHODOLOGY - AN EXPLORATORY EXPERIMENT

Although it has been said that the best way to kill a project is to put an unready prototype through a field trial, often the best way to find flaws and get improvements is through field testing.[4] The process is guaranteed to be messy, but it can yield a wealth of information. We should also be mindful that simulations are often kinder than reality, and that a failed experiment may avoid more serious consequences. Once a reasonable first approximation of a scenario generator was built, it was subjected to a limited number of exploratory trials. Applications were developed and tested with the help of practitioners. The development of these applications served to refine the procedure and as a partial test of the prototype's potential utility.

To assess whether a computer based scenario generator has value for practitioners as opposed to more common manual methods, the program was subjected to an iterative process of refinement. It was given domain-specific information, and tested against a particular application by generating scenarios for that application in the given domain. It was reviewed by knowledgeable practitioners, who assessed the output for plausibility and utility.

DISSERTATION OUTLINE

This dissertation looks at implementation theory, scenarios, and computer modeling. Aspects of each are adapted to create and apply an instrument or tool for the policy/program implementor.

The instrument discussed in this dissertation may serve not only in determining how a policy change or innovation can be put in place but also to assist in the execution of the implementation process. Weick states that, "the map is the territory,"[5] and what policy/program implementers need is a map to guide them through the difficult terrain to successful implementation. The generator assists in the creation of cognitive maps in scenario form. These maps are intended to permit the development of detailed and explicit plans for managing the implementation of policy and the proactive execution of these plans. In the process, something should be gained in our understanding of scenario building, in the capabilities and limitations of computer-based aids to human action as well as in furthering our grasp of public policy processes.

Chapter 2 outlines the literature relevant to this research. Discussions of policy implementation threading through public administration writings are traced to identify key principles and important contrasts. Game theory is examined for possible application to some of the criticisms of policy implementation. The types and uses of scenarios by public and private entities are reviewed, and available techniques from computer modeling and artificial intelligence are presented.

In Chapter 3 the overall generator process and the particulars of the computer program are described. The compromises between program complexity, data base comprehensiveness, and user requirements are discussed. The plan for experimenting with the generator is described, including test issues and criteria for exploring the functioning and potential utility of the instrument.

Chapter 4 reports on the results of the generator trials. Ten cases are presented, and the results of each discussed. Of the ten, three can be termed moderate successes. The particulars of the remaining seven are also discussed for what lessons may be learned from them.

Chapter 5 is a discussion of the experimental trials and of what conclusions can be drawn from the exposure to which the generator procedure was subjected. Although the ultimate goal of this effort was not achieved, the process and outcomes offer some insights.

Chapter 6 contains some recommendations for directions to be followed in further development of this approach. Suggestions for redesigning the generator are considered, along with comments on the place of scenarios in the implementation planning process.

SUMMARY

Public administration in general and policy implementation in particular have been the subjects of a bad press. Some of the grist for the mill of invective comes from scholarly comments such as that of Pressman and Wildavsky:

> Public Policy has been given a bad name by efforts to accomplish what no one knows how (or is willing) to do. It is not that professional people are less capable than their predecessors; on the contrary, their knowledge and competence do grow but not as fast ... as what they need to know.[6]

This dissertation is an attempt to close some part of the gap between theory and practice implied in comments such as the above. It was intended that, once the available thought on the subject had been summarized, a conveniently usable mechanism could be demonstrated which would materially assist public administrators in discharging their responsibilities. How all this was approached and how successful the effort was is the subject of the succeeding chapters.

ENDNOTES TO CHAPTER 1

1. Jeffery L. Pressman and Aaron Wildavsky Implementation: How Great Expectations in Washington are Dashed in Oakland; or Why it's Amazing that Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals on a Foundation of Ruined Hopes (Berkeley: University of California Press, 1979), p. 168.

2. George C. Edwards III and Ira Sharkansky The Policy Predicament: Making and Implementing Public Policy (San Francisco: Freeman, 1978), p. 10.

3. David A. Rosenbloom "Public Administration Theory and the Separation of Powers" in Public Administration Review 43 (May/June 1983), p. 219.

4. Arthur J. Alexander The Linkage Between Technology, Doctrine, and Weapons Innovation: Experimentation for Use (Santa Monica, CA: Rand P-6621, 1981), pp 15-16.

5. Karl E. Weick The Social Psychology of Organizing, 2nd ed, (Reading, MA: Addison-Wesley, 1979), pp. 249-251.

6. Pressman Wildavsky, op. cit., p. 166.

CHAPTER 2

LITERATURE SURVEY

This chapter considers different ways of seeing public policy implementation, and how available techniques and technology might be employed to assist practitioners in planning and executing policy and program implementation strategies. This survey will touch on discussions of policy implementation, gaming, scenarios, and computer models. The intent is to identify the basis for a computer-based, practical simulation program which generates plausible, timed sequences of future events associated with the implementation of a public policy or program.

STUDIES OF IMPLEMENTATION

While concerns for the practical results of public policy decisions are as old as the study of government[1] and "economy and efficiency" were central concerns at the founding of Public Administration, the explicit study of policy implementation as a distinct topic is more recent. With the growth of the "systems approach" to policy analysis in the 1960's, scholars applied analytical approaches to problems of implementation.[2]

Much of the early literature had an expressed or implied critical view of the complexities and inefficiencies of governmental processes. Implementation had been identified as a locus of problems. It was thought that systems analysis would point the way to solutions. In one of the early works on the subject, Douglas Bunker describes a three dimensional space in which the power, interests, and positions of significant actors on implementation issues may be located. He further considers how the "multiplicative combinations might provide some estimate of the required values for a minimum effective coalition to achieve implementation."[3]

In 1973 Pressman and Wildavsky's Implementation,[4] which described the failure of a 1968 Economic Development

Administration project in Oakland, California, was published, and the use of the term "implementation" became a standard Public Administration topic.[5] In 1975, Hargrove declared implementation to be the "missing link" in policy research.[6]

The literature on policy and program implementation is too voluminous for a comprehensive treatment here, but certain themes are particularly relevant. Different schools of thought look at implementation through different lenses. In 1976, Hargrove identified three research schools: (1) political scientists who discovered that the carrying out of public programs is a complex political process, (2) others attempting to develop "implementation estimates" of the institutional and political consequences of structuring programs in given ways, and (3) investigators into specific public programs.[7] The three groupings described by Hargrove come at their descriptions of implementation from different theoretical bases, and their prescriptions vary accordingly.

O'Toole and Montjoy suggest the first group's orientation is toward processes, and their prescription for success includes substantial delegation of authority. The second group adopted a 'top down' perspective and sought to find ways of structuring mandates so that implementers will have little chance to exercise discretion.[8] The third group is focused on specific cases. We will follow Hargrove's classification, and examine each in turn. We will label the first group as "process-oriented," and the second group as "planning-oriented."

THE PROCESS ORIENTATION

Scholars from Hargrove's process-oriented category took some of the first looks at implementation in response to perceived failures in the social programs of the late 1960's. Pressman and Wildavsky took the view that implementation was as much evolution as it was a controllable process.[9] In 1977, Eugene Bardach saw the implementation of mental health reform in California as a series of loosely coupled processes or "games." He suggested a number of type games with catchy names, such as "Easy Money," "Piling On," "Pork Barrel," and so on. He did not suggest that his taxonomy of games was exhaustive or precise, but he did suggest that implementors could benefit from writing scenarios that described possible paths the implementation process might take. Implementors could employ these scenarios to better design and manage their programs.[10]

In 1978, Michael Lipsky observed that a hierarchical, systems model (such as that favored by a planning orientation) directs attention to issues of command, control, and coordination. However, the people who carry out a policy often actually make the policy in many circumstances, and systems models do not reflect this process.[11] Ingram and Mann suggest that the policy to be implemented is simply a point of departure for bargaining among the implementing agencies, and what materializes as implemented policy is essentially determined by specific local circumstances and characteristics, which are unique to each implementation context.[12]

In their discussion of the Oakland project, Pressman and Wildavsky make reference to probability theory. They calculate the odds of a multi-phased project's success, with a high but less than absolute probability of success in each phase, as being almost zero.[13] This excursion does a disservice not only to mathematics but also to practitioners. If these numbers were a true reflection of the realities of a highly complex and interdependent situation, then we would all be better off saving our energy.

In making their admittedly whimsical statement, Pressman and Wildavsky ignore the interdependence which characterizes many of the bits and pieces of the implementation process. This interdependence is reflected in alternative perspectives focusing on such phenomena as bandwagon effects. Put another way, the interdependence of the many facets of the implementation process may be strong enough to outweigh adverse specifics, and carry the program along.

Astute politicians, bureaucratic and otherwise, are aware of this. In ironic contrast to the implementation difficulties documented by Pressman and Wildavsky and others, are programs which seem to enjoy if not immortality, then, at least, nine lives. Freeman's "iron triangles"[14] of agency, members of Congress, and constituency groups have often demonstrated the capacity to keep favored programs going regardless of the difficulties. The best (or most flagrant) examples are some defense systems, but, as Hedrick Smith observed that the iron triangle paradigm operates for virtually every department in the executive branch, for every major interest group, for every major region of the country.[15]

The process-oriented posture leads to a reliance on market forces and on the pulls and tugs of bargaining for the solution to problems. The basic contention being that centralized, top-down programs to address public needs are high risk and prone to failure due to the many, often unforeseeable, impediments and complications of implementation. Consequently, governance options are limited, and we should rely on markets or harnessing market forces to accomplish the ends of public policy.

We are led by the process-orientation to the sense that successful policy implementation requires the delegation of broad discretionary authority and flexibility. Given adequate delegation, implementors can deal with problems as they arise. Broadly stated policy goals are key to obtaining optimal outcomes, and market-like processes yield the best results. Policy options which require centralized control are to be avoided. Thus by favoring certain means, the process orientation tends to favor certain ends.

We may turn to the process-orientation, drawn by the "vividness" of their descriptions and the power of their critique. However, as Bruce Adams has complained, this orientation draws attention to the immediate as opposed to the long term. Further, there are serious drawbacks to the reactive style of management that buries officials with the immediate to the exclusion of the important.[16] An assistant city manager has remarked:

> It's true: there is a lot of "muddling through" out here in the "real" world. But public administrators cannot settle for mere muddling. The stakes are too high.[17]

Put another way, the process-oriented models are descriptively incomplete, and normatively inadequate.

THE PLANNING ORIENTATION

Hargrove's second category, which has been dubbed "planning-oriented," attempted to find general, summary patterns to describe the implementation process. These frameworks, in turn, identify important, objective variables. These variables provide the keys to planning and evaluation of the prospects for implementation.

According to Palumbo and Calista, policy making process are divided into two parts: the formulating process and the carrying out process. These processes may overlap considerably both in time and in terms of substantive concerns. Formulation includes (A) problem conceptualization; (B) theory evaluation and selection; (C) specification of objectives; (D) program design; and (E) program structure. The carrying out process includes (A) resource adequacy; (B) management and control structure; (C) bureaucratic rules and regulations; (D) political effectiveness; and (E) feedback and evaluation.[18]

Mark Moore suggests a method for making "feasibility estimates" of specific policy proposals which includes the following steps: (1) identifying the major activities and policy choices logically implied by the general policy proposal; (2) gauging the sensitivity of the desired outcomes to the particular ways in which the activities are carried out or the policy choices resolved; (3) locating political and bureaucratic factors operating in the local setting which will affect the character of the activities and the choices; and (4) making a prediction about the actual performance of the government in adopting and implementing the policy proposal.[19]

In 1975, Van Meter and Van Horn offered the following model[20]

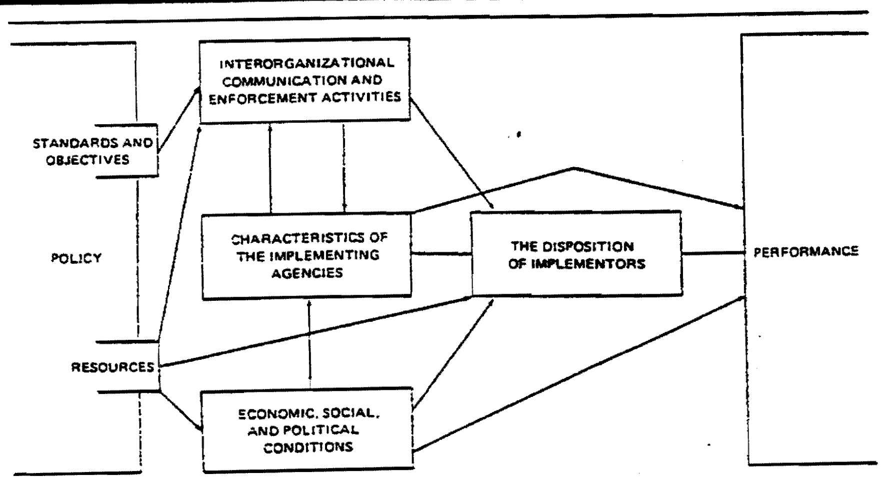

Figure 1: A model of the policy iplementation process

Sabatier and Mazmanian look for (1) sound theory, (2) unambiguous policy directives, (3) skilled implementing agency leadership, (4) active constituency and political support, and (5) whether the relative priority of statutory objectives is not significantly undermined over time by the emergence of conflicting public policies or by changes in relevant socioeconomic conditions that might undermine the statute's "technical" theory or political support.[21]

Nakamura and Smallwood include questions about the political climate (key actors, their beliefs and resources), the resource base (leverage or inducements to move actors), mobilization potential (sources of opposition, support, and compromise), and assessment indicators (criteria for measuring success).[22]

The patterns described by all of the above are informative, but, from the perspective of a public servant facing a specific implementation situation, somewhat abstract. While they might improve general understanding, specifics and details often are insufficient to assist materially in facing real world problems without a substantial effort. They also may not truly describe the actual processes. According to Denis Palumbo, these models may be helpful to some sense of understanding, but provide insufficient guidance for practical action.[23]

The top-down, planning approach seems to diminish in worth as practical considerations draw near. Harold Wolman formulated a set of 38 "hypotheses" as questions to guide both researchers and policy-makers. These questions are general, for the most part, and require some adaptation to the specifics of a given situation.[24] Consider, for example, the following pair of suggestions by Wolman concerning the proper organizational location of a research and evaluation office:

> Placing research capability within the operating unit greatly increases the probability that feedback will actually come to the attention of program managers.
>
> Placement of the research function in a separate unit, or in the office of the agency or department director increases the likelihood that an objective evaluation will be made but decreases the likelihood that it will come to the attention of appropriate program managers and policy makers.[25]

Somewhat helpful perhaps, but the organizational design question remains open. Two conflicting principles are left for the practitioner to resolve according to the unspecified details of a particular situation. Thus the planning orientation literature is vulnerable to the criticism of being no improvement on what Simon described as "proverbs of administration."[26]

CASE STUDIES

Studies of specific implementation cases abound. We would include under this heading the multitude of internal reports generated in public agencies as part their normal operations. Some of this information makes it into the open literature. Pressman and Wildavsky's book mentioned earlier is one. Other examples include Derthick New Towns In-Town,[27] Bailey and Mosher ESEA: The Office of Education Administers a Law (Syracuse: Syracuse University Press, 1968),[28] Murphy State Education Agencies and Discretionary Funds,[29] and Percy Disability, Civil Rights, and Public Policy: the Politics of Implementation,[30]

The process and the planning orientations rely on selected cases in support of their arguments, as must any theoretical posture. As interesting as a given case may be, some theoretical framework is necessary if useful generalizations are to be drawn. Simply piling up specific studies leads nowhere. Berman observed that reviewing a wide sample of these retrospective cases leaves one feeling somehow wiser but still very uncertain as to how to apply this wisdom in other than the special circumstances already past.[31]

SYNTHESIS

There have been attempts at synthesizing the process and planning orientations. Walter Williams focused attention on the processes of implementation as the solution rather than the problem. To him, conflicts were an inevitable outgrowth of a constitutional system of checks and balances. Rather than either seeking total control or allowing programs to evolve on their own, implementation consisted of bringing communication, commitment, and capacity to bear to achieve the desired policy goal.[32]

Bishop and Jones suggest that implementation has two stages and two tiers of variables: one preparatory and one executory. They view implementation as a continuation of the political process of policy making. In the preparatory phase, implementors plan and arrange actors, strategy, and practices to their best advantage for execution. Once execution has begun, it is too late to prepare, and the game has to be played out according to the circumstances as they arise.[33]

Similar syntheses have been suggested by Helen Ingram, Soren Winter, and others.[34] Although highly informative and enlightening, some choices have to be made between conflicting paradigms and sets of assumptions before the theory can be applied to a specific set of circumstances.

The simplified characterization of process versus planning as opposite paradigmatic extremes is not trivial since initial assumptions color both diagnosis of problems and the prescriptions for their solution. Stone noted that control of the bureaucracy is itself a political issue and analysis of the implementation process is an ideological weapon in an ongoing struggle for administrative power.[35] Underlying the different perspectives on implementation are different assumptions, and a choice of theoretical perspective implies a preference for certain means and ends.

The central question in the debate over implementation theory can be reduced to "how much discretion?" Maynard-Moody observed that implementation theory was born out of the recognition of the lack of connection between legislative and administrative policy making. Further, bureaucracies were inefficient conductors of legislative will.[36] In response, a process orientation would delegate a substantial amount, rely on market-like forces, and expect the result to be optimal. A planning orientation places greater value on the policy's stated goals, and would seek mechanisms to assure the achievement of these goals.

The perspectives discussed above may not be totally reconcilable. However, both the process-oriented and the planning-oriented models can be useful in planning and executing public policy decisions. A practitioner, following the suggestion of Etzioni's Mixed-Scanning,[37] may take the planning perspective for the long view, and follow a process orientation for analysis of the nearer term. Bardach's suggestion for scenario-writing[38] may offer a further way to bring the two perspectives into agreement.

We can view the situation as one in which successful implementation is differentiated from failure by how well these "games" are played. Adapting Etzioni, implementors could combine both the long- and short-view in a detailed scenario. Put another way, we might get at the big picture by putting together one piece of the puzzle at a time. If policy implementation is characterized as a game or series of games, then should not a player benefit from a game plan if she or he wishes to decisively influence the outcome? Finally, game plans themselves are based on scenarios composed of a linked series of situations and the probable actions of the other players.

Each step to be negotiated in the implementation of a given policy or program can be represented by a specific situation governed by an ultimately knowable set of rules for allowable participant actions and resultant outcomes. The suggested simulation generates a forecast of future events. Of course, forecasts serve many purposes. The most important is to predict the future state of something as well as possible, using existing knowledge.[39] The issue is not whether the processes of public policy implementation can be simulated and forecast, but whether any such simulation or forecast can offer sufficient value to justify the effort to produce it.

One further note is in order. The focus of this effort is on current, actual experience. After Rosenbloom, we should pay attention to the wisdom of the public administration practitioners whose action is circumscribed by considerations of constitutional checks and balances, and administrative and political pressures. Individual public administrators are often called upon to integrate the three approaches to public administration [political, managerial, legalistic] and much can be learned from their experience.[40]

With the above in mind, we will now turn to consideration of the means to create experience based, forecasts, or scenarios, of the possible futures facing implementors. Since Bardach chose to describe the key processes of implementation as games, we will turn to game theory first to see what it has to offer.

GAMES AND SIMULATIONS

Zagare defines game theory as branch of mathematics developed to deal with conflict of interest situations in social science.[41] The bulk of the game theory literature concerns the mathematical representation of specific conflict situations under what are, for us, very restrictive assumptions. What follows does draw what inspiration it can from that literature.

Although some authors, including many cited here, have used the word "game" in a pejorative sense, it can be used to describe an analytical approach to modeling human interrelationships. More formally, a game is an <u>activity</u> among two or more independent <u>decision-makers</u> seeking to achieve their <u>objectives</u> in some limiting context. A more conventional definition would say that a game is a contest with rules among adversaries trying to win objectives. The trouble with this definition is that not all games are contests among adversaries - in some games the players cooperate to achieve a common goal against an obstructing force or natural situation that is itself not really a player since it does not have objectives.[42]

A game may be a particular way of looking at something, anything. This "way of looking" has two main components, a rational, analytic one and an emotional, creative, dramatic one. The game's analytic component sees in certain aspects of life - family, love friendship, education, profession, commerce, war, politics, partying - common formal or structural characteristics identical to those of games.[43]

However, game theory, like other technologies, has been oversold. Nigel Howard once claimed that game theory is becoming a unifying force in the social sciences, encompassing economics, psychology, politics, and history within a single mathematical theory capable of being applied to the understanding of all interactions between conscious beings.[44] However, he goes on to admit that very abstract game-theoretic models have been of limited use for theorizing about social interaction. Devoid of psychological, sociological, or structural information, these models ignore precisely those features of the real world - e.g., socialization patterns, socioeconomic hierarchies, societal norms, power distributions, economic or political arrangements, and so on - that social scientists argue are the most important determinants of human behavior.[45]

Although the instrument we are attempting to construct and apply cannot use much of the rigorous work done on many restrictive cases, the concept of a multiplayer, non-zero-sum game is useful. Embedded within the institutional and procedural structures, we can identify a number of recurring multi-party, interactive processes which can be modeled as "games" (involving both competition and cooperation) that are played by the various parties concerned. These processes fit the looser definition of an activity where individuals or teams confront a situation and develop actions that, with the other competing or cooperating teams, produce a new situation.[46]

Any use of the (non mathematical) game metaphor or methodologies carries possible rewards and risks. Game-type activities can be used for analysis, to train, and to propagandize. Simulation games may allow the player, however imperfectly, to experience reality quickly and cheaply. Experience is often the margin between failure and what you should have done. Games enable players to obtain a thin margin of experience.

On the minus side, games are not a panacea. They are often oversold and ineptly done. A bad game is worse than none at all, as it gives an illusion of experience where there is none.

Games enhance personal involvement. Despite what one would assume, well done games get their heaviest use in solitaire play. This is one of the reasons why users prefer computerized games over manual ones. The computerized game has lower workload and is more easily adapted to solitaire use. Players quickly discover that the game format is an exceptionally efficient means of obtaining information on a subject. Games transmit more information more quickly. As TV programmers and advertisers have long known, people operate more on the visual than anything else. The visual displays in games get across a lot more information much more quickly than text or speech.[47]

The instrument proposed in this paper will have to simulate, for the observer, the processes of implementation. As a simulation, the program should present a representation of the real system that includes entities of the system and the behavior and interactions of those entities. Simulation models are constructed to emphasize certain aspects of the system while ignoring others, based upon the goals of the study.[48]

The program to be offered is to simulate, in part at least, what may be characterized as a series of loosely coupled games. To Bardach, for example,... the "implementation process" is (1) a process of assembling the elements required to produce a particular programmatic outcome, and (2) the playing out of a number of loosely interrelated games whereby these elements are withheld from or delivered to the program assembly process on particular terms.[49]

Defense planners make extensive use of the game metaphor in developing and analyzing strategies and other type decisions. The study of conflict situations goes back centuries, and offers some analogies to the implementation problem. Designing an implementation campaign may be likened to planning a complex military operation. However, the military analogy does have its limitations. Clausewitz notwithstanding, war is, in some ways, simpler than politics - and some wars end.

PLANS AND SCENARIOS

The goal of this paper is to develop an instrument to assist in generating a set of scenarios, which can be used to anticipate, plan for, and negotiate through a series of interactive processes with variable possible outcomes. After all, Bardach and others have used the term "game" to describe the policy implementation process. If we are seeking a way to deal with the systemic obstacles to successful policy implementation, what we need is a game plan. As House and Mcleod put it, an implementation plan is concerned with how to do something. Such a plan specifies what actions by what persons and institutions will bring a preferred strategy into being.[50]

To create a game plan in this context, we must consider the scenario. The term "scenario" has been abused, and is commonly used to describe virtually any product of thought, from a hunch to an intention, from a general strategy to a detailed plan, from a singular future possibility to the most convoluted sequence of ploy and counterploy.[51]

Scenario is taken to mean a story about the future, which may be fiction, but could actually come to pass, or a script-like characterization of a possible future presented in considerable detail, with special emphasis on causal connections, internal consistency and concreteness.[52]

To be useful to practitioners, the scenario should have sufficient detail in the appropriate places to serve as a guide for action. We must be careful in discussing scenarios to consider just what is the intended use and methodology employed in its creation. Herman Kahn describes scenarios as hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision points. They answer two kinds of questions: (1) precisely how might some hypothetical situation come about, step by step? and (2) what alternatives exist, for each actor, at each step, for preventing, diverting, or facilitating the process?[53]

Scenarios are more than scenery. Carl Builder notes that because scenarios describe the future -- as projected, assumed, speculated, or hypothesized -- they can foreordain the results and conclusions of planning studies. What purports to be the results of rigorous analysis may be mostly the inevitable products of the chosen scenario.

Further, and speaking directly to our requirements, Builder says that scenarios are chains of events, and that these events are of two kinds: acts of volition and acts of nature. These event chains are ordered in time, and each event in the chain establishes a new state of the world, derived from the previous state of the world, but modified by the acts of nature or volition that make up that particular event. Thus, a scenario can be seen as a chain of transition events that result in a continuously changing state of the world.[54]

However, in order to appreciate the types of scenarios, and the underlying assumptions. Boucher offers a taxonomy of scenario types consisting of demonstration, driving force, system change, and slice-of-time. Scenario writing modes include: exploratory (with two variants - "play out" and "surprise-free"), normative (with variants - "favored and attainable" and "feared but possible"), hypothetical (with variants - "best case" and "worst case").[55]

Some corporations use multiple scenarios in their strategic planning. Pierre Wack, discussing the use of scenarios in a major oil company, observes that scenarios deal with two worlds: the world of facts and the world of perceptions. They explore for facts but they aim at perceptions inside the heads of decision makers. Their purpose is to gather and transform information of strategic significance into fresh perceptions. This transformation process is not trivial - more often than not it does not happen. When it works, it is a creative experience for participants and leads to strategic insights beyond the mind's previous reach.[56]

We are concerned with questions of efficacy - that is, success in implementing a given policy choice, and, to that end, the "system change" type scenario is the most appropriate. Further, we should be clear that this effort has a normative tint, in that the objective is to describe how a presumably desirable goal can be attained.

For purposes of managerial planning, scenarios are complimentary to econometric forecasting and stochastic simulation. Schoemaker notes that instead of striving for supreme rationality within a necessarily simplified view of the world, they permit a semi-rationality in which intuition and analysis combine to manage highly complex tasks. They do this by providing a sense of general direction, without being a precision compass.[57] Schoemaker differentiates between a "learning scenario" and a "decision scenario," and suggests a ten step process for scenario writing. His steps include: (1) define the issues, (2) identify the major actors, (3) list current trends, (4) identify key uncertainties, (5) construct two forced scenarios, (6) assess the internal consistency and plausibility of these artificial scenarios, (7) eliminate the incredible, (8) assess the revised scenarios in terms of how the key stakeholders would behave in them, (9) re-examine the internal consistencies of the learning scenarios, (10) Finally, re-assess the ranges of uncertainty of the dependent (i.e. target) variable of interest, and retrace Steps 1 through 9 to arrive at decision scenarios that might be given to others to enhance their decision making under uncertainty.[58]

With all of the foregoing in mind, our next step is a review of aspects of computer modeling in order to identify principles for the design of the scenario generator.

COMPUTER MODELING

Although revenue-maximizing entities may focus on monetized information in their projections, public agencies must consider a multitude of factors, only some of which may be expressed in quantitative terms. Consequently we will concentrate on methods of manipulating qualitative information in the form of text.

As should be clear, a computer-supported scenario generator, in its simplest form, should produce a series of sentences - subject (actor) and predicate (setting, verb, object) - which describe a plausible sequence of events. Unfortunately, research has not yielded either a practical algorithm or consistent principles for generating coherent text.[59] To restate the problem: to be useful, some procedure must examine a set of inputs and generate a set of subject-predicate statements in a logical sequence. We will survey some potential alternative approaches, including largely manual methods, commercial games programs, systems dynamics, and artificial intelligence.

Earlier in this chapter, methods of scenario writing were mentioned with no comment as to whether computer support could be available. What may be the largest, most detailed scenarios are written in support of defense exercises.

Although supported by word processing and file transfer services, these scenarios are written manually. The primary objective of these exercises is (or was) to drill theater command staffs and defense agencies on the procedures established for transitioning to a major war footing and the conduct of joint and combined operations. The scenarios employed can be extensive and complex. The efforts of many people throughout the organization are required to research, write and coordinate the master exercise scenario.[60]

It is always possible to fall back on manual methods of writing a scenario, but this costly and time consuming approach is what we are trying to avoid. However, deferring the question of how to obtain a comprehensive data base of possible events, what methods might be employed to generate scenarios with machine support?

We might turn to the many retail computer games available today. These come in seemingly endless variety, and can be roughly categorized as arcade, educational, or strategy. Arcade games usually replicate some eye-hand activity such as flying an aircraft, driving a race car, or shooting aliens, and they offer little to help with our concerns.

Educational games are of various types, many of which present interactive lessons on a given subject. The line between education and simply playing for fun becomes blurred when we consider games of strategy, and here we might find something of interest. Games of strategy are often simulations of real, historical, or imaginary situations, casting the player in some role or other. The computer may be the opponent, or may moderate a game between one or more people.

The standard strategic game programming approach involves a loop which controls any number of hierarchically ordered modules: game initialization, player move, command processing, machine move, conflict resolution/outcome determination, and game termination. Underlying the modules is some sort of record reflecting the status or state of all relevant elements in the game. In a simulation of a battle this might include the location, status, and activity of each combat unit. The processing modules cause changes to the simulated states of the game elements, which are fed back to the players in graphical displays or text.

Some commercial products address governmental type problems. For example, SimCity is a game in which the player (SimMayor) plans and manages a simulated metropolis. A sequel, SimEarth, allows the player to try managing a planetary ecology.[61] Yet another in the series, SimHealth, considers the outcomes of alternative national health policies. These and similar games are dependent on a detailed and static data base of one form or another. There is no question that a simulation of equal sophistication could be constructed for any selected policy implementation situation, but this would require the development of an appropriate data base tailored to the specific application of interest.

Games are routinely produced for a variety of commercial management purposes. Business simulations are generated to support strategic decision-making, research problems, and provide management training. Because business management simulations are oriented toward profit-maximizing entities, they are difficult to adapt to the situation confronting public agencies. The objective of these simulations is usually to earn money. Where a problem facing a public official is "business-like" in its character, a business management game may be available and appropriate or adaptable. However, such applications will account for only some of the public policy implementation situations we may encounter.

We will next consider "system dynamics" as an alternative approach to the modeling of complex social systems.

SYSTEM DYNAMICS

System dynamics is the combination of four developments: the concept of information-feedback systems, decision automation, the simulation (as opposed to the analytical) approach to understanding complex systems, and the development of low-cost digital computing power.[62] Perhaps the best known application of system dynamics is The Limits to Growth[63] which stirred up considerable discussion after its publication in 1972.

The basic concept of system dynamics is the representation of complex social systems by a quantitative model which is a "statement of system structure."[64] The basic component of such models is the feedback loop whereby the rate of change of some variable is regulated by feedback from the value of that variable. These loops are the basic building blocks of what can be large models. The loops themselves can be complex, reflecting information and physical delays, interactions with other loops. and both positive and negative feedback.[65]

System dynamics assumes that behavior is principally caused by structural variables including physical aspects such as plant and production processes and intangibles such as policies and traditions. It assumes that these variables can be represented numerically. These variables may reflect amplification, time lags, and information feedback in a fashion similar to that found in complex engineering models.[66]

System dynamics has been employed to model industrial, ecological, social, and political systems for research, policy, and management purposes. It has been vigorously attacked and, just as vigorously, defended.[67] An important criticism of system dynamics is that its models cannot be validated. That is, the accuracy of a model's output values cannot be assessed. The defense is that the models should not be judged by their ability to predict exact values, but by their ability to reproduce the behavior characteristics of the system - stability, oscillation, growth, average periods between peaks, general time relationships between changing variables, tendency to amplify or attenuate externally imposed disturbances, and so on.[68]

Although specific policy implementations might be amenable to modeling with system dynamics techniques, each situation would require the construction of such a model from scratch. The difficulty stems from the nature of implementation problems and a key assumption of the systems dynamics approach. System dynamics models assume structural (in the above sense) stability. A difficulty with implementation problems is the fluidity of this structure. While system dynamics promises to enlighten us on the dynamic consequences of long-term trends, interrelationships, and perturbations on some fixed set of relationships, implementation problems are characterized by fluctuations in these very relationships.

To create a system dynamics model, some representation would have to be developed of the structure of the problem. The model parameters would then be estimated, and the model tested for its faithfulness to the (assumed) behavior characteristics. Each model is "sui generis," however useful for its particular problem. A new model would be required for any other implementation problem, and a minor change in key relationships in the original model might require it to be overhauled.

Although system dynamics itself may not be well suited to creating scenarios, the concepts of feedback loops, delays, oscillations, and so on should have an prominent place in the generator's repertory.

We will turn next to a consideration of artificial intelligence - at least some selected components which offer some promising approaches to the type of text manipulation which is required for generating scenarios.

ARTIFICIAL INTELLIGENCE

The literature on artificial intelligence speaks to some of our interests, and is extensive, if inconclusive. Schank observes that most practitioners of "artificial intelligence" would agree on two main goals of artificial intelligence. The primary goal is to build an intelligent machine. The second goal is to find out about the nature of intelligence. However, when it comes down to it, there is very little agreement about what actually constitutes intelligence. It follows that little agreement exists in the artificial intelligence community about exactly what artificial intelligence is and what it should be.[69]

One of the godfathers of artificial intelligence is, of course, Herbert Simon,[70] and a number of works were (and are being) published under its aegis by such scholars as Feigenbaum, McCorduck, Nii, and Schank.[71] We will draw selectively from this literature, looking for hints and fragmentary suggestions rather than a complete and immediately applicable package. We will consider the artificial intelligence literature in two areas: information processing (including expert systems, autonomous robots, and neural networks) and language representation.

The use of computers in attempts to support human decisions has a common manifestation in rule-based, or production, "expert systems."[72] These employ hierarchies of rules, usually in paired if-then statements, to produce some concluding statement. One common usage is in diagnostics. The user provides some initial information; the computer takes these statements, checks for matches with if-statements, and selects the associated then-statements. These then-statements become the new if-statements, and the process is repeated until a terminating then-statement is reached. That terminal statement constitutes the output.

Thus, a medical production system might require input of statements concerning patient vital signs, medical history, and test results. The output would be a statement of a medical diagnosis. Production systems have proven to be very powerful tools for case specific applications where the rules are many but can be exhaustively and comprehensively known. However, their application is usually confined to one specific domain. For example, an expert system designed to identify specific viruses has a tough time with the symptoms of blunt force trauma.

An alternative approach can be found in the work by Rodney Brooks on autonomous robots.[73] These efforts make no claim to intelligence (artificial or otherwise), but rather seek to create an architecture for autonomous devices that display a range of behaviors which, while limited, are sufficient for selected tasks. The key to these robots lies in distributed, layered control. Instead of decomposing the architecture into sequentially ordered, functional modules, such as perception, modelling, and planning as shown below,

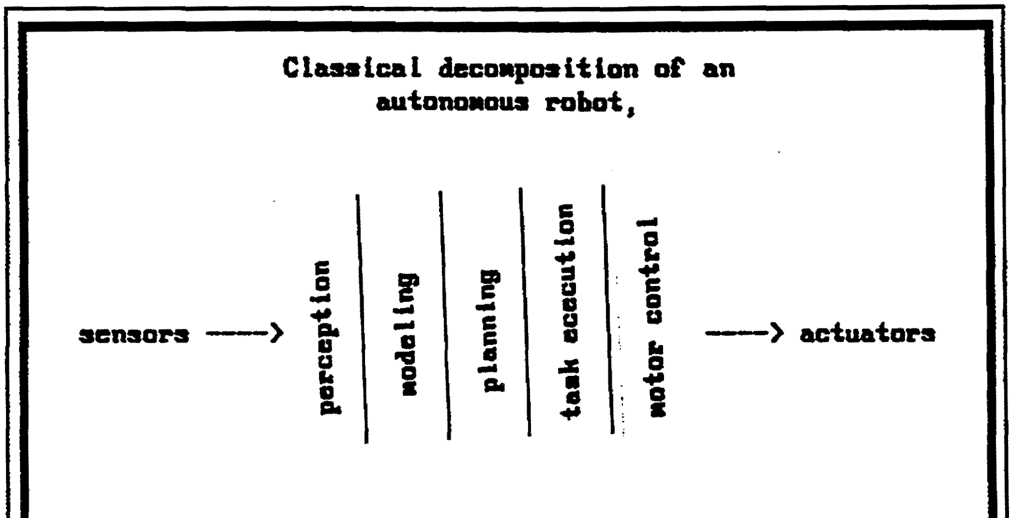

Figure 2: Sequential Functional Architecture

the architecture is decomposed into a hierarchy of task achieving modules, also called "behaviors."

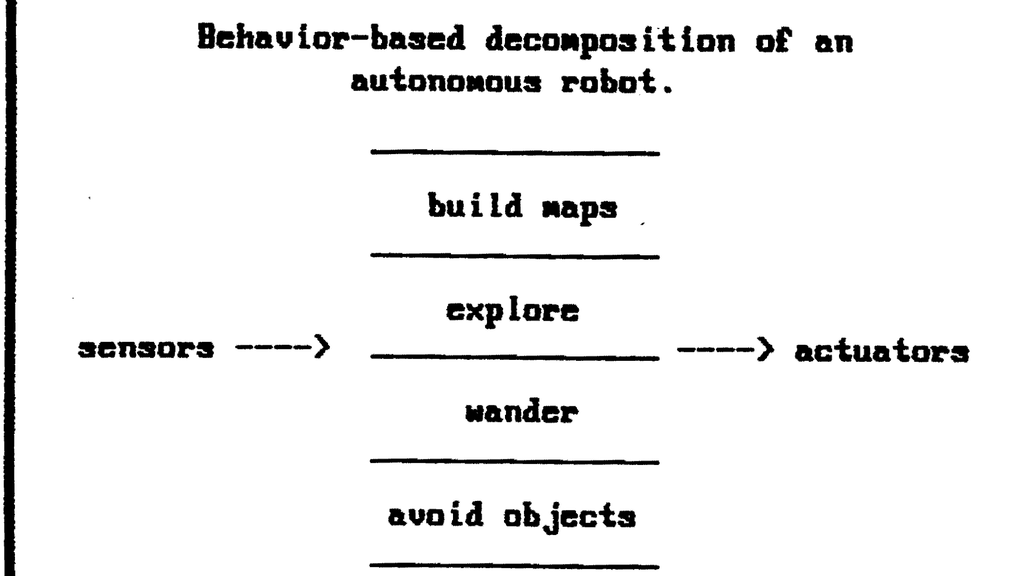

Figure 3: Parallel Behavioral Architecture

The concept of hierarchical behaviors which Brooks uses to program robots is appealing, and seems to work well in mimicking insect behavior. Further, such robots could be effective in a number of applications.[74] However, the context of public policy implementation requires a model of the hierarchical levels and the scope of relevant administrative behaviors. It is, in other words, a situation analogous to that of expert systems, where an extensive case-specific set of rules is required to deal with the complexities of a given situation. Although caricaturists might be satisfied with a simple, universal set of administrative behaviors, the behavior set would require careful review and revision for each domain and application.

Other possibilities are suggested by work on "parallel distributed processing," which are also known as "neural networks." Of particular interest are the possibilities of an approach called "pattern association" by Rumelhart and McClelland.[75]

The model is based on an N x M matrix of the weighted connections between some N element input array and an M element output array. The values of each matrix cell (or "connection" in a one layer pattern associator) are established by multiple iterations of a trial and error correcting procedure.[76] The resulting matrix may be applied to prediction if the arrays are keyed to events. That is, given, say, events A, B, and C, a pattern associator may signal that we should expect event Y. We do not assume that the goal of learning is the formulation of explicit rules. Rather, we assume it is the acquisition of connection strengths which allow a network of simple units to act <u>as though</u> it knew the rules.[77] The parallel distributed processing approach does have some limitations, and the matrices use up computer memory exponentially.

However the approach can be applied to generating scenarios, as we will see in the next chapter.

We must consider how to get information into an electronic data base and how that data is to be processed. In its raw state, our data will be text or language. That is, a scenario generator can only be based on some set(s) of statements about what may occur. These statements could reflect historical occurrences or be speculative predictions. A method is required to take available information, generalize or abstract that data, and find ways to make generalized predictions by some regular process. For a specific application, the case information will have to be generalized to be compatible with the predictive patterns, and then generalized predictions made. Finally, the process should suggest what those predictions mean in the terms of the case being examined.

The situation is not simple. Mallery notes that as a central feature of strategic language and decision, referential opacity poses a debilitating dilemma for semantic universalism. Opaque contexts are linguistic situations where statements are scoped by belief-suspending constructions, such as potentially counterfactual verbs of belief, intention, or request. Verb tense or aspect indicating future occurrences, subjunctive mood, or conditionals have the same effect as do adjectives like "imaginary." Opaque contexts require an understander to independently determine the referential status of their contents. Semantic universalism's perceptual apparatus, discrimination nets, provides no means of identifying opaque contexts. That is, the meaning of a statement in its particular context must be known in advance. Addition of this capability would require a representation of surface semantics before decompositional perception - but that obviates the need for a universalist representation.[78]

Representing language is essential for a system which is to produce readable scenarios. We will discuss how a workable, if not universalist, text representation may be obtained in order to permit a generator to operate.

Although some structure is required in order to represent information in computationally tractable terms, the concepts have been difficult to pin down. Minsky argues that the ingredients of most theories both in artificial intelligence and in psychology have been on the whole too minute, local and unstructured to account - either practically or phenomenologically - for the effectiveness of common sense thought. The "chunks" of reasoning, language, memory, and "perception" ought to be larger and more structured, and their factual and procedural contents must be more intimately connected in order to explain the apparent power and speed of mental activities.[79]

Advances in computer modeling have not yet yielded anything approaching intelligence or human creativity.[80] For our purpose, we must rely on some combination of perceptions of past patterns and subjective projections as the basis for future scenarios.

If all possibilities under all conditions were known along with their respective causal relationships and probabilities of an occurrence, a single, grand model would be feasible. This model, an enormous strategy-type simulation or "adventure game," would postulate a series of process arenas, with stereotyped actors, rules, and outcomes.[81] Although such an approach might be feasible for a limited instance, such a model would be case-specific, costly in terms of effort, and not applicable to other policy problem domains without significant rework.

CONCLUDING REMARKS

The obvious analogy brought to mind by the foregoing is that of the ten blind men and the elephant. It is not obvious that this research can do much better, given the complexity of the problem and the limitations of the tools available. However, we will continue, and attempt to describe a method which is based on readable statements about real events, which captures or represents sufficient universal meaning from these statements to permit computer manipulation, and which delivers readable statements in the form of a plausible scenario.

We will exploit elements of the work mentioned above. Keep in mind that although they may display complexity and sophistication on the surface, computational models, at their core, have to be simple. Ones and zeros underlie everything. Subsequent chapters outline an effort to achieve the right mix of these simple elements to provide a sophisticated product.

While proceeding to construct the prototype instrument, we should be mindful of the risks. These, in addition to getting the potentially objective factors (structure, linkages, processes, actors) wrong, include, after Davis: failure to treat asymmetries of the mindsets of the various players, failure to treat the bounded rationality which characterizes administrative behavior, and trivialization by a preference for the tractable as opposed to the significant.[82]

However, the objective is to improve policy outcomes, and the approach of choice implies control. Which, in turn, generates it own demands. Hans Reichenbach notes that to control the future - to shape future happenings according to a plan - presupposes predictive knowledge of what will happen if certain conditions are realized.[83]

Put another way, predictions are often involved in complex ways as causal factors in the decision-making processes that shape social action, which itself affects the chances of predictions turning out to be correct. Predictions are part of the steering and social control mechanisms of society and are connected to outcomes by feedback loops. The ability to control leads to prediction and the ability to predict leads to control. "Knowing" the future is partly a matter of knowing how to control it.[84]

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CHAPTER 3

GENERATOR DESIGN and TEST

As discussed previously, the intent of this dissertation was to develop a scenario generator in the form of an interactive computer procedure. This generator would produce descriptions of plausible sequences of future events associated with the implementation of given public policy decision. The goal was to produce scenarios that are sufficiently explicit to useful to administrative officials. That is, the generated scenarios should materially assist in planning for an actual policy implementation. The user should gain insights into the future consequences of present actions and possible changes in the situational environment reflected in the scenarios.

The intention behind testing the generator was to get some sense of how well it worked and to obtain some rough idea of what the potential users want. In a fashion analogous to systems development, once the prototype generator was developed, it was given some test runs, and evaluated against a previously prepared test plan.

GENERATOR CONCEPT

To produce scenarios, we envision three required elements: a user, a set of operating procedures, and the generator in the form of a computer program. The generator program itself has three major design considerations: how much reliance to place on the actual computational process? how much can be captured in data base coverage? and, how much is then to be required from the user? Although initially it was hoped that some existing algorithm or program structure could be located which could bear most of the burden of generating coherent, plausible scenarios, no such procedure was found. After consideration, the conclusion was reached that any scenario generator would depend upon a domain-specific data base. Neither did development of one, universally applicable, data base appear feasible, since the specific actions, situations, and language associated with the implementation of different policies differ widely.

The chosen approach asked each user for a substantial amount of information about their situation as well as about the policy of interest. This information was embedded in a series of statements, formatted in a specific manner so that they can be related to each other, and contained in separate files from which a set is selected for each scenario. The intent was to generate scenarios for each example case with whatever level of analyst involvement seemed required, and thereby to accumulate generalizable domain information. As more cases were examined, the size of the accumulated data base should grow until, at some point, user input requirements would diminish. Ultimately a user should only have to describe the attributes of the policy to be implemented and to select from available domain data files. This is not to suggest that the generator can "learn" about implementation, but rather that as case information is accumulated, the requirement for domain data from subsequent users should diminish.

The program operates on a data base built from a selected set of formatted text files. The program will accept any number of "domain" data files which establish the possibilities for a given situation. One file containing the user's action plan or "application" file is also required to trigger the process of interest. The data base files are specified for each run, and can be changed to suit the requirements of a particular situation. For example, in a particular case, a domain data base might call on separate files covering municipal budgeting, personnel management, and licensing of medical professionals, while the application tests the response to a budget cut and an expansion in the professions requiring licenses to practice. Another case might call on files reflecting state level single agency cutbacks, establishment of a new bureau, and an application testing response to the adoption of novel processes in service delivery.

A scenario generated without the application file would reflect a "no-action" alternative. An overview of this concept is reflected in figure 4.

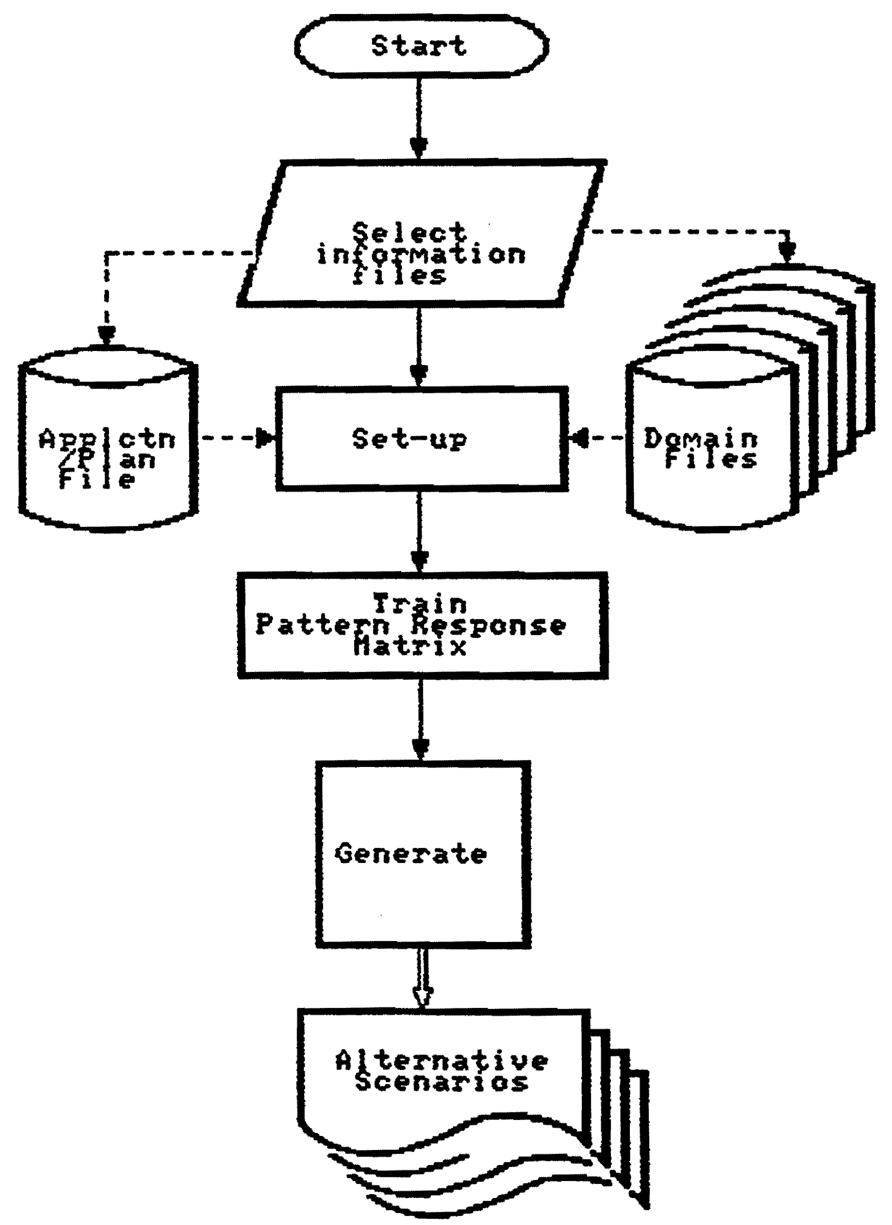

Figure 4: Generator Concept

DATA STRUCTURE

The model depends on a particular representation of events, and the relationships between them. In structuring events, we have adapted Burke:

> We shall use five terms as generating principles of our investigation. They are: Act, Scene, Agent, Agency, Purpose. In a rounded statement about motives, you must have some word that names the act (names what took place, in thought or deed), and another that names the scene (the background of the act, the situation in which it occurred); also, you must indicate what person or kind of person (agent) performed the act, what means or instruments he used (agency), and the purpose.[1]

An event, for purposes of this model concept and the way model output is presented, has the following basic form:

date, actor, act, prop.

where:

date: is the point in time the event occurred.

actor: is a specific person, collection of persons, or some animate object capable of executing a given action, given a specific role or purpose.

act: is what the actor did at the date indicated, and, to the extent necessary for understanding, the relevant context for the action.

prop: is any instrument, tool, agency, or object acted upon.

Note that, in this formulation, elements of Burke's taxonomy have been merged or modified.[2]

Further note again that we are talking about events, which are defined by Nance as a change in object state, occurring at an instant ...,[3] which we can associate with a specific date, rather than activities which extend, more or less, over a period.[4] This simplification will facilitate computational tractability, but will require the user to mentally provide, or "read in" the activities which lead up to the events displayed. We should not be too uncomfortable with this, since we are accustomed to getting information about our environment in the form of event statements. The media reports the news mostly as events, for example, rather than on-going activities or processes.

THE MAIN PROGRAM

The program is written in Borland's Turbo C, and in what follows, the key functions will be outlined in "pseudocode" format. The program's main function is simply:

```
main(){
     set_up();
     train(MATRIX);
     generate();
}
```

Where,

> MATRIX is a N by N floating point matrix which will be created, trained, and used to generate pattern responses, and the "set_up," "train," and "generate" functions will be described in turn.

The scenario generation procedure is intended to reflect how interested parties respond to change in the form of efforts to implement a new policy or program. Some of what these parties do will be prompted by the implementation process or its secondary effects, and some would happen anyway. That is, "system" can be envisioned as having some process components which are essentially static (predictable, occurring at a specific future time), some predictable based on precursor events, and others, that, after Morrison, are predictable based on some identifiable pattern of events.[5]

To facilitate processing, the data bases contain stylized event statements of three types:

Calendar events	-	which should occur at a specific point in time.
Reaction events	-	which occur, or are executed, in response to some one specific event stimulus.
Pattern events	-	which are responses to patterns of several events.

SET-UP PROCEDURE

Once the user has specified the domain and application files and has instructed the generator to execute, the program goes through its set-up procedure. Set-up consists of processing the selected domain files and the application file into forms useable by the program. The procedure scans each file in turn, and processes the statements after finding certain prompt words. The flowchart in figure 5 describes the set-up process.

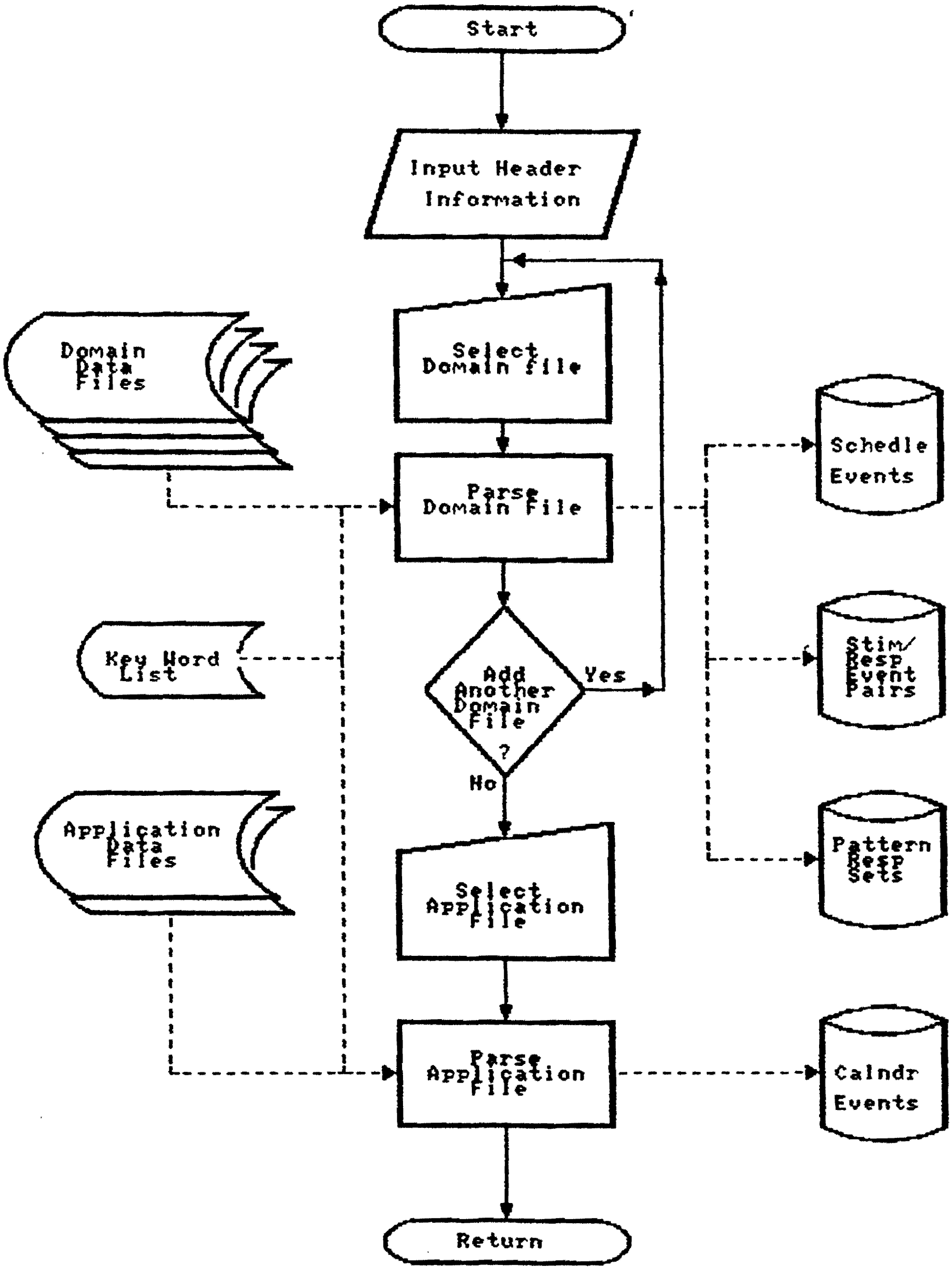

Figure 5: Setup Procedure

As each information file is selected, it is read from disk storage, and its statements are parsed into "actor-act-prop" format where codes are substituted for the actors and props specified in the file's key word dictionary as shown in figure 6.

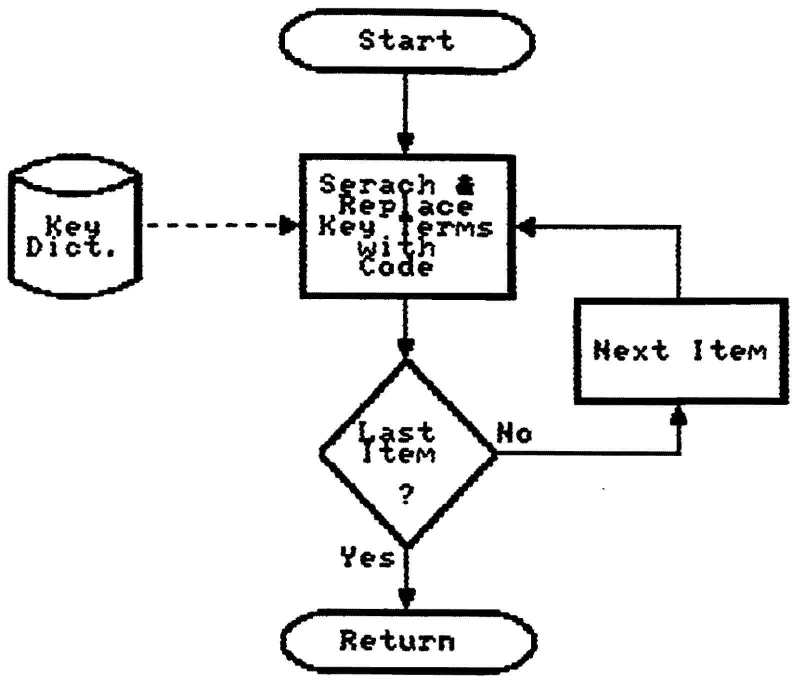

Figure 6: Parsing Procedure

Some generalizability and comparability between files is achieved through the use of what we will term a "key word dictionary." Each data file, domain and application, contains a list of paired key words or phrases which relate selected key components (nouns or noun clauses) of the specific text statements to ideal types. The initial selection of just what types are to be included was arbitrary and limited to a minimum sufficient to demonstrate the procedure. However, as information concerning specific domains is accumulated, the list may be expanded. A key-word dictionary for a data file is formatted as follows:

```
CAST
     national service IS mission.
     President IS champion.
     grant awards IS concept.
     $2.3 billion IS budget.
     Virginia IS state.
     Fairfax IS locality.
     New York Times IS 1st national media.
```

The word "CAST" signals that what follows is a series of key word definitions. Notice that each statement is a simple sentence of the form "Abc" IS "Xyz." In the statements which follow this list, each occurrence of the phrase "national service" is replaced by a code for mission. Each occurrence of "President" is replaced by a code for champion. Thus, a statement in the domain file which reads "The President delivered a speech strongly supporting national service" would be converted into "The champion delivered a speech strongly supporting mission." After having these substitutions made, the program assembles the required temporary lists and manipulates the statements as will be described shortly. The resulting scenario then substitutes the key-word definitions from the application file before the events in the scenario are printed. This procedure hardly qualifies as an advance in "natural language understanding,"[6] but it does permit some generalizability between domains.

For example, consider a simple stimulus-response situation. We will examine this particular process in more detail later, but for now assume a pair of statements such as if "New York Times opposes national service" then "President argues for grant awards." Say that this pair appears in a domain file which is included in a model run, with the "CAST" shown above. This stimulus-response pair would be converted and stored as:

media opposes mission.
champion argues for concept.

Now assume that the application file, in its "CAST" section, states:

Washington Post IS media.
medical service IS mission.
County Executive IS champion.
free clinics IS concept.

Finally, assume that as the scenario is generated, a statement such as "media opposes mission" is encountered. The stimulus-response procedure will then generate a scenario statement: "champion argues for concept." When the scenario is printed the key-word definitions from the application file will be substituted, giving:

...
Washington Post opposes medical service.
...
County Executive argues for free clinics.

The first group of event statements in a domain file are events which are to occur on a specific date. The process creates an initial scenario from all the calendar events in the domain files. These events follow the prompt "CALENDAR." Here is a fragment from a domain file:

CALENDAR

ON 11/12/94	NATO commits substantial forces to Balkan peacekeeping.
ON 12/03/94	Russia expresses concern over Turkish role in Balkans.
ON 01/28/95	US involvement in Balkans escalates to 250,000 troops.

ON 03/15/95 Balkans conflict broadens to include Albania and Bulgaria.

ON 04/20/95 Hungary and Romania caught up in ethnic conflicts.

ON 06/12/95 Balkan conflict now a full scale war between UN forces and Slavic Alliance.

Each statement is headed by the word "ON." The statement is placed in the scenario, which is a linked list of event statements in chronological order.

Next a table of stimulus-response event pairs is created from the statements following the prompt "STAR." Here is a fragment:

```
STAR

IF   NATO commits substantial forces to Balkan
     peacekeeping.
THEN_AFTER 0130 DAYS
     Tensions between North and South Korea escalate.

IF   NATO commits substantial forces to Balkan
     peacekeeping.
THEN_AFTER 0170 DAYS
     Iran attacks Iraq to seize Basra area.

IF   NATO commits substantial forces to Balkan
     peacekeeping.
THEN_AFTER 0200 DAYS
     President declares National Emergency, and calls for
     mobilization.

IF   NATO commits substantial forces to Balkan
     peacekeeping.
THEN_AFTER 0210 DAYS
     Congress authorizes military conscription.
```

These are a bit more complex. The prompt "IF" identifies the stimulus statement. "THEN_AFTER xxx DAYS" specifies the period of time which passes between the stimulus event and the response event. The response event follows the prompt "DAYS."

Once the prompt "STRAT" is encountered, the set-up procedure sets up the lists to handle the pattern response events specified in the domain files. Pattern response statements look like:

STRAT

GIVEN	President Clinton signs National Community Service Trust Act into law.
AND	NATO commits substantial forces to Balkan peacekeeping.
AND	Secretary of Defense lobbies against further expansion of National Service.
AND	US involvement in Balkans escalates to 250,000 troops.
AND	Congress authorizes military conscription.
THEN	Congress acts to subordinate community service to military requirements.

The pattern response matrix is prepared from statements consisting of several stimulus statements (prompted by "GIVEN" or "AND" and one response statement, prompted by "THEN." These statements are parsed into actor-act-prop format, and placed in a list. The numbers identifying the elements of each statement are in two arrays (input and target) which comprise the "training sets." These training sets are used to "train" the pattern response matrix. The training sets have the form of pairs of "N" element arrays of ones and zeros, where the number "N" is the number of parsed events in the data base. The first array reflects a stimulus pattern, and the second reflects the response. These data base patterns are used to train a simple pattern-associator, or weight, matrix using the delta rule as described by McClelland and Rumelhart.[7] The procedure adjusts the weights, or elements in the pattern-associator matrix, on each pass so as to reduce the difference or error measure. The training process is outlined in figure 7.

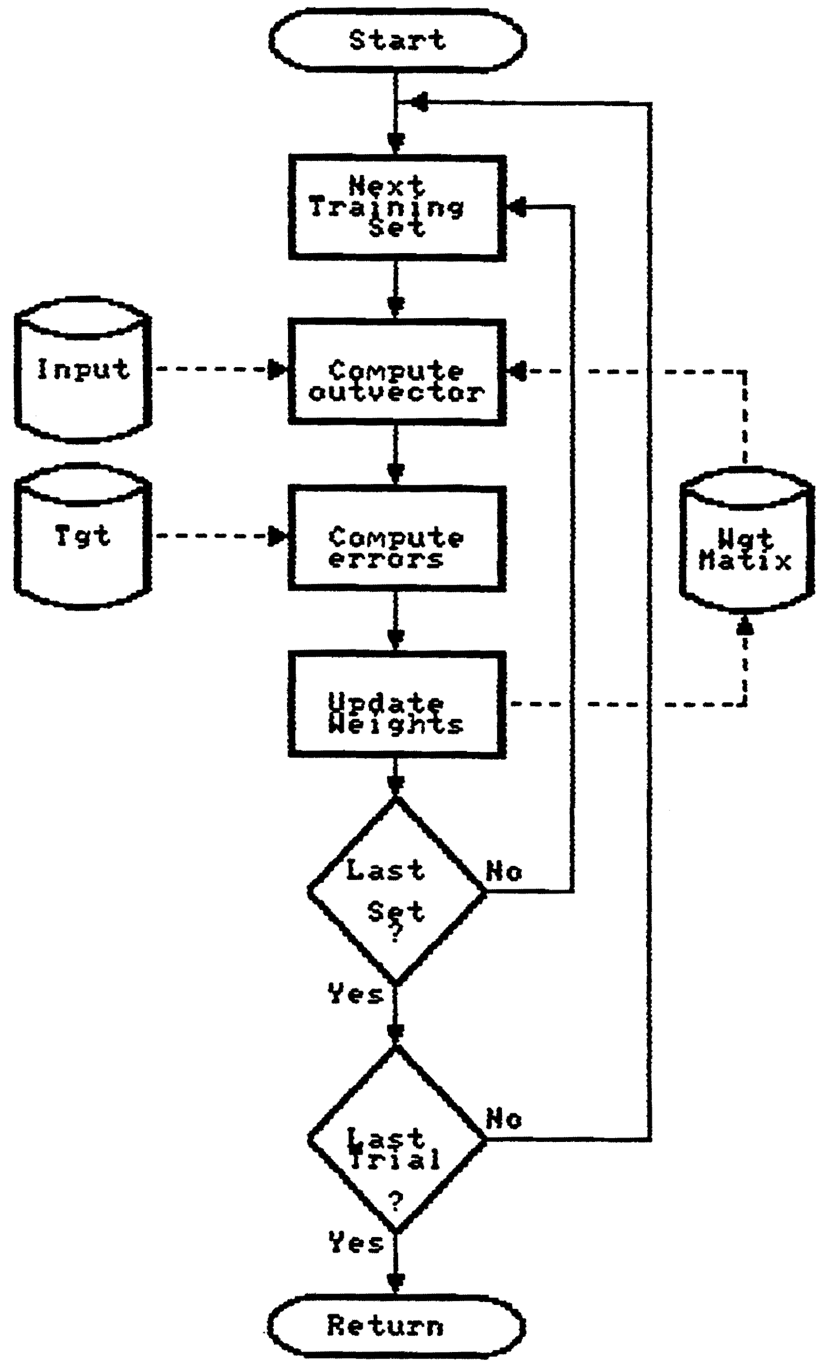

Figure 7: Matrix Training Procedure

The training process, in pseudo C code:

```
train(MATRIX){

   allocate MATRIX ( N x N )  memory

   for 100 iterations{

     for each training set
        selected invector elements = 1
          selected targetvector elements = 1


     for each targetvector element j
        for each invector element i
          activation j += invector*MATRIX[i][j]

     for each targetvector element j
        error = targetvector j - outactivation j

     for each targetvector element j
        for each invector element i
          MATRIX[i][j] += l_rate*error j*invector i
     }
}
```

Where:

```
N = number of events in data base.
MATRIX = N by N floating point matrix.
invector[N] = N element array of 1 or 0.
targetvector[N] = N element array of 1 or 0.
activation[N] = N element floating point array.
error[N] = N element floating point array
l_rate = a constant, used to increment or decrement
     the connection weights in the matrix.
```

Once selection of domain files has been completed, the user specifies an application file. The application file is parsed in the same fashion as domain files with the exception that a separate table of application scheduled events is prepared instead of adding those date specific events to the scenario event list. Stimulus-response pairs and pattern responses are merged into the tables prepared from the domain files.

GENERATION

Once set-up and training are completed, generation is initiated. Generation of the scenario is described in figure 8.

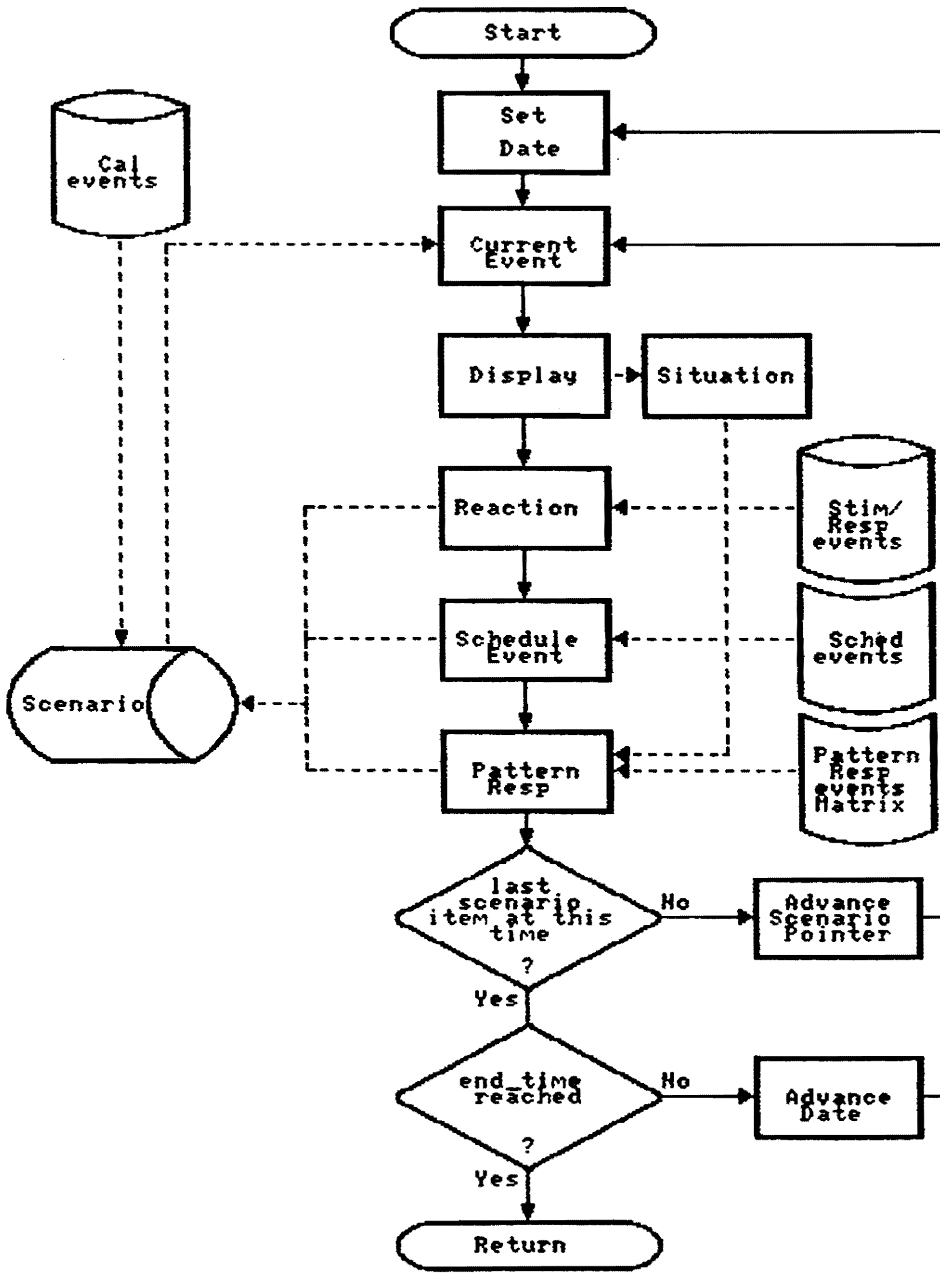

Figure 8: Generation Procedure

In pseudo C code:

```
     generate{

          current_date = START_date;

          scenario_pointer = start;

          while(current_date < end_date){
           while(scenario_pointer->date == current_date){
               display(scenario_pointer)
               situation[scenario_pointer] = 1
               stimulus_response(scenario_pointer)
               if next scenario_event_date >=
current_date
                    advance scenario pointer

          }

          schedule_response(current_date)

          pattern_response(situation)

          advance current_date by 1

     }
```

The generator examines one day at a time, and the process begins with assignment of a start date. The scenario event list, prepared during set-up from calendar events in the domain files, is examined to determine whether an event occurs on that date. If so, it is displayed on the screen and printed. It is also added to an array which tracks the situation.

Next, the list of reaction event pairs is examined to see if the scenario event triggers a response. If the reaction list has an entry, the response item is added to the scenario. The date associated with an event is calculated by adding a duration term associated with the response event to the current date.

The application schedule event list is examined next to see if any events are scheduled for that date. If so, they are added, and the list of reaction event pairs is checked again.

Once all reaction, schedule, and calendar items for the current date have been processed, the array which tracks the situation is compared with the pattern response network to determine whether any responses are generated. The current date is then advanced, and the process continues until a specified ending date is reached.

In principle then, the generator is based on three simple processes and some bookkeeping rules which should allow it to appear plausible to a user. Details of each of the three ways events are generated, and what provisions have been made for scheduling priority, will be discussed in more detail in the following sections.

GENERATING CALENDAR/SCHEDULED EVENTS

The process for selecting events is inspired by Thompson,[8] and, although not necessarily reflective of real causal order, will suffice for this simulation. As we have seen, calendar events are contained in the domain data files. It is assumed that these events will occur on the dates specified - e.g. Independence Day will be on July 4th. Calendar events might include any presumed to be sufficiently probable such as elections, initiation of the budget cycle, and so on. Also, exogenous events of any variety can be introduced into the scenario by placing them in the calendar.

Schedule events are similar, being "caused" by the clock reaching a certain date, but are listed in the application file. Schedule events are timed events which are a part of the user's plan for implementation, and might include program authorization, resource approval, or whatever is assumed to occur at a specified point. Schedule events may be delayed or overridden by the next type.

GENERATING REACTION EVENTS

These are simple stimulus - response events. That is, given:

type-actor "A," action "B," stake "C".

Then, after a delay, we will see:

type-actor "D," action "E," stake "F."

In pseudo C code:

```
stimulus_response(scenario_pointer){

     for each stimulus response pair
          if(scenario_pointer == stimulus)
               if(response j not duplicate)
                    store(response j)
}
```

Reaction events override all others. That is, a reaction event essentially precludes the actor involved from generating any other event until that reaction event is completed. This is intended to assist in reflecting the dominance of routines and SOP's in selecting behaviors when a conflict with another type occurs. Another way to look at this type of sequence is described in figure 9.

Multiple responses to a single event can be handled by having multiple pairs in the data base as in figure 10. From a user's point of view, this is indistinguishable from figure 11.

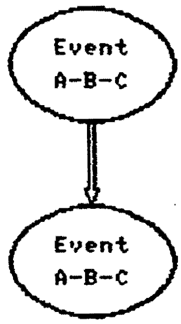

Figure 9: Single Event Reaction

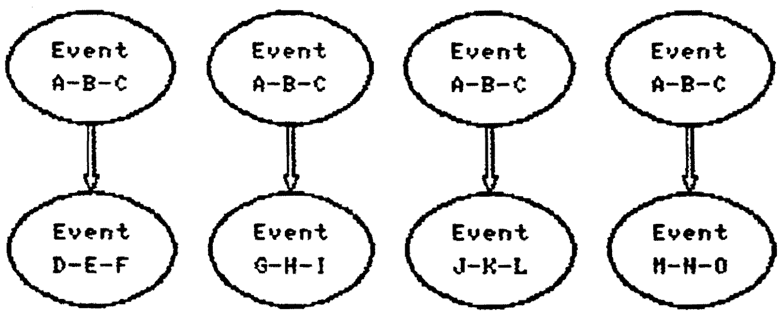

Figure 10: Parallel Event Reactions

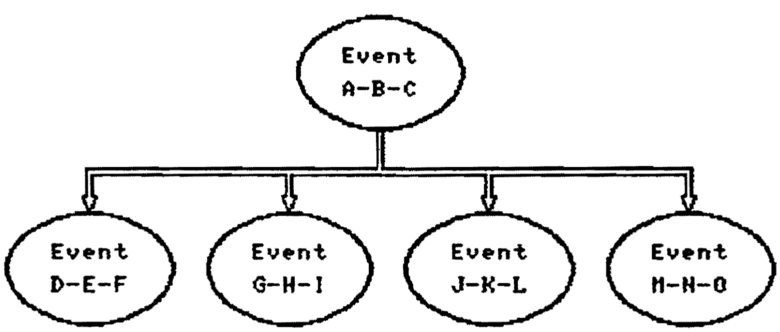

Figure 11: Multiple Reactions

GENERATING PATTERN RESPONSES

Pattern response events are meant to reflect decisions and other events which are based on complex patterns of stimuli. If a response event is "excited" beyond a set threshold value as stimulus events are recorded and the actor involved is not otherwise engaged, the event is entered into the scenario list. In pseudo C code:

```
pattern_response(situation){

   for each possible event j
      for each situation element i
         activation j += situation i * MATRIX[i][j]

      for each possible event j
           if(activation j  > threshold)
                if(response j not duplicate)
                     store(response j)
 }
```

Note that while reaction type events can handle multiple responses to a single event, pattern responses model single events springing from multiple event stimuli. This is modeled in figure 12.

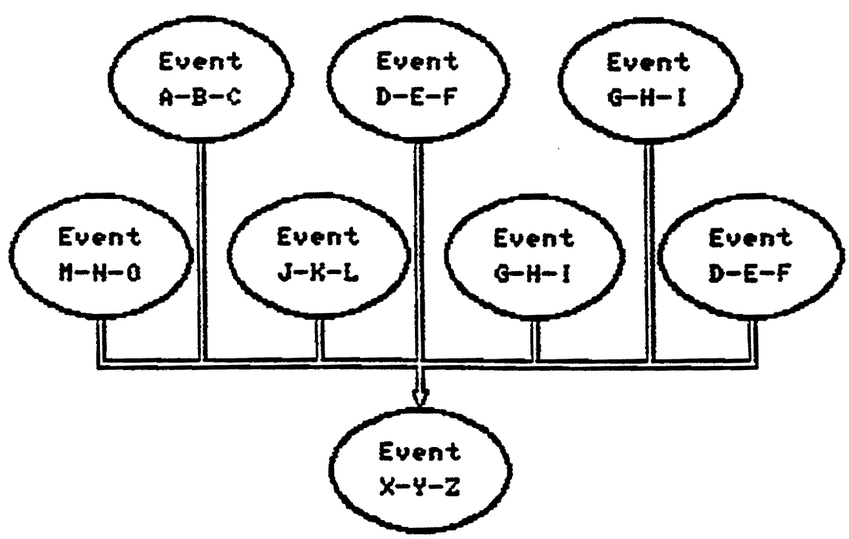

Figure 12: Pattern Response

The three approaches to event generation permit the generation of complex scenarios. Events can occur as a consequence of simple "lock-step" reactions, a pre-ordained schedule, or in response to a pattern of events, some of which may be statements of preference or condition. It is possible to have events which are hidden from user view when the scenario is printed or displayed. Feedback loops may be created by either reaction sequences or pattern responses, and delays are accommodated in the reaction event structure.

The process of generating scenarios for a given situation proceeds in iterative steps: selection of previously prepared application and domain files, scenario generation, and user comments on the scenarios. User comments may prompt development of new domain files, modification of existing files, and a new or modified application file. As many different scenarios as are desired can be prepared.

The next step is to try this approach to generating scenarios in some actual situations.

TEST DESIGN

The testing, or trials, of the generator were subject to a prepared test plan. The plan states the objective of the test, the issues or questions to be answered, the criteria by which each issue is to be judged, and the data or information to be collected under each criterion. This step is not intended to be an evaluation of a final product. Rather it is part of a process which proceeds on a "test-fix-test" basis. For the time being, we are interested in indications of ultimate utility, and with gleaning suggestions as to how to proceed for further development.

TEST CONCEPT

The process of each test case proceeds in iterative steps:

1. The situation is discussed with some agreeable "respondent," who has an implementation problem, and data files for the problem domain and application are developed;

2. The program is loaded with domain and application specific information;

3. Scenarios are generated;

4. These scenarios are reviewed by the respondent, who assess the output for plausibility and suggests changes;

5. Comments are converted into data base entries, and the scenarios regenerated;

6. The process continues until it appears that adding to or further changing the set of scenarios would bring no additional utility (or the respondent indicates that they do not wish to continue);

7. The respondent is asked to provide an assessment.

The test objective, issues, and criteria are described below. Exploratory test cases were selected by what the General Accounting Office terms the "convenience" method,[9] which, while abhorrent to statisticians, was the only practical design - given the immaturity of the tested process. An effort was made to include different policy types and scopes at different levels of government. Possible respondents were solicited to participate, and, for those who chose to do so, information was collected, scenarios generated, and the utility of the process assessed by interview and informal questionnaire. An outline of the process is depicted in figure 13. Specifics of the test objective, issues, and criteria follow. A sample scenario generated by the program appears in annex A to this chapter.

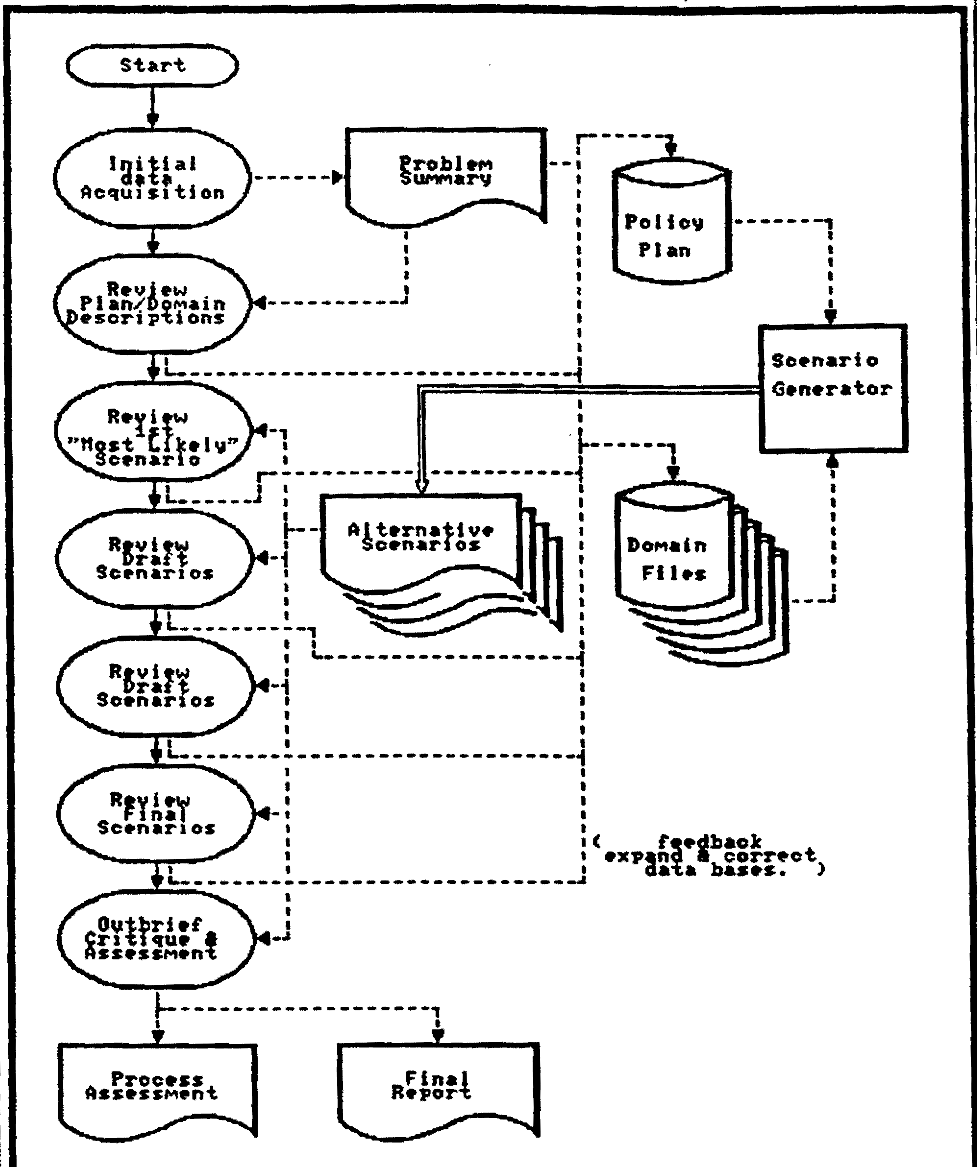

Figure 13: Exploratiory Trials

TEST OBJECTIVE: Assess whether the computer supported scenario generating procedure has value, as opposed to more common intuitive methods, to practitioners.

ISSUES AND CRITERIA:

ISSUE 1. Does the program generate event sequences which mimic the dynamics of real world processes?

CRITERIA 1.1: Events, of the various types, are listed in the scenario at the appropriate time.

SCOPE: Given appropriately coded data base entries.

DATA ELEMENTS: Data base entries.
Output listings.

PROCEDURES: Programmer review.

ISSUE 2. Does the program generate plausible scenarios?

CRITERIA 2.1: Knowledgeable professional practitioners state that scenarios generated by the model are at least possible, although not necessarily likely or desirable, sequences of future events.

SCOPE: Given appropriately coded data base entries, scenario output.

DATA ELEMENTS: Data base entries.
Output listings.
Practitioner comments.

PROCEDURES: Questionnaire, interview.

ISSUE 3. Does the procedure have utility in planning and executing policy implementation?

CRITERIA 3.1: Knowledgeable professional practitioners state that scenarios generated by the program have some utility in planning.

SCOPE: Given appropriately coded data base entries, scenario output.

DATA ELEMENTS: Data base entries.
Output listings.
Practitioner comments.

PROCEDURES: Questionnaire, interview.

ISSUE 4. What are the user-visible shortfalls in program design and data base content?

CRITERIA 4.1: Knowledgeable professional practitioners suggest obvious additions and/or deletions to/from program data base.

SCOPE: Given coded data base entries, scenario output.

DATA ELEMENTS: Data base entries.
Output listings.
Practitioner comments.

PROCEDURES: questionnaire, interview.

CRITERIA 4.2: Knowledgeable professional practitioners suggest obvious problems with program processes.

SCOPE: Given coded data base entries, scenario output.

DATA ELEMENTS: Data base entries.
Output listings.
Practitioner comments.

PROCEDURES: questionnaire, interview.

With the foregoing in mind, we will now discuss the trials of the generator and the responses elicited from those who were exposed to it.

Annex A to Chapter 3: Sample Scenario.

```
**************************************************
*                                                *
*                                                *
*                POLICY  RESEARCH                *
*               SCENARIO  GENERATOR              *
*                                                *
*                                                *
*                Edward H. Leekley               *
*               NOT FOR DISTRIBUTION             *
*                                                *
*                                                *
* SUBJECT:  National Community Service.          *
*  CLIENT:  Donald J. Eberly.                    *
*                                                *
*  FILES:                                        *
*         NAT_SVCS.DOM                           *
*         NAT_SVCS.APP                           *
*                                                *
* RUN: 1994/01/08:14:32:39.                      *
**************************************************
```

September 29, 1993
US Congress passes National Community Service Trust Act.

October 4, 1993
President Clinton signs National Community Service Trust Act into law.

October 14, 1993
President nominates CNCS Board of Directors.

November 5, 1993
New York Times notes Presidential support for National Service.

November 9, 1993
Congress passes CNCS appropriation.

November 28, 1993
Senate Confirms CNCS Board of Directors.

November 30, 1993
Commission on National Community Service begins setup operations.

January 1, 1994
CNCS headquarters staff begins operations.

March 4, 1994
CNCS headquaters reorganization largely complete.

March 6, 1994
CNCS announces interim procedures for planning and program grants.

March 8, 1994
All States have identified NCS POC agencies.

May 7, 1994
First National Community Service planning grant awarded.

June 7, 1994
First National Community Service program grant awarded.

September 30, 1994
National Community Service enrollment is reported at 20,000.

October 11, 1994
Wall Street Journal notes minimal nature of early CNCS contributions.

November 2, 1994
Election returns marginal Democratic Congressional majority.

May 6, 1995
60 Minutes features an analysis of rising college tuition rates.

August 21, 1995
Wall Street Journal reports steps to curtail funding for student loans.

September 30, 1995
National Community Service enrollment is reported at 33,000.

October 11, 1995
Time reports limited National service contributions to environmental clean-up.

October 15, 1995
New York Times notes National Service authorization below critical mass.

September 30, 1996
National Community Service enrollment is reported at 45,000.

October 11, 1996
Secretary of Defense lobbies against further expansion of National Service.

November 5, 1996
Democratic Administration wins slim majority in national election.

January 1, 1997
GAO issues a report critical of lack of focus in National service grants.

January 1, 1997
Washington Post editorial notes diffused, insignificant CNCS impacts.

January 21, 1997
National service subject to further budget cuts.

*************** *** END *** ************

ENDNOTES TO CHAPTER 3

1. Kenneth Burke A Grammar of Motives (Berkeley, CA: University of California Press, 1969) p. xv.

2. Ibid.

3. Richard E. Nance "The Time and State Relationships in Simulation Modeling" in Communications of the ACM 24, 4 (April, 1981), pp. 176.

4. James F. Allen "Towards a General Theory of Action and Time" in Artificial Intelligence 23 (1984), pp. 123-154.

5. Foster Morrison The Art of Modeling Dynamic Systems: Forecasting for Chaos, Randomness, and Determinism (New York, NY: Wiley, 1991), pp. 167, and Chapters 12-17.

6. Avron Barr and Edward A. Feigenbaum The Handbook of Artificial Intelligence Vol. I. (Reading, MA: Addison-Wesley, 1981), pp. 223-322.

7. James L. McClelland and David E. Rumelhart Explorations in Parallel Distributed Processing: A Handbook of Models, Programs, and Exercises (Cambridge, MA: MIT Press, 1988), pp. 83-159.

8. James D. Thompson Organizations in Action: Social Science Bases of Administrative Theory (New York: McGraw-Hill, 1967), pp. 54-55.

9. United States General Accounting Office, Program Evaluation and Methodology Division Case Study Evaluations Transfer Paper 10.1.9 (Washington, DC: US Government Printing Office, 1990), pp. 34-37.

CHAPTER 4 - TRIAL RUNS

This chapter reviews the trial runs of the scenario generator. Since the generator and procedures for its use were in such a rudimentary stage and participation in any trial offered no guarantee of benefit for the time and effort, solicitation for candidates for trials was limited to acquaintances and referrals. In other words, the sample for test cases was selected on the basis of convenience.

Possible candidates were told of the experimental nature of the generator, how it was to be used, and what might be expected at each stage in the procedure. A total of ten of those approached agreed to consider at least one scenario. Of these, three had several alternative scenarios prepared. First draft scenarios were prepared for the other seven. However, for various reasons, those trials were not completed. We will first consider three cases which completed the seven-step experiment, and then turn to the others who did not complete the process for what can be learned from those experiences. After summarizing the ten trial attempts, the test issues and criteria will be assessed.

Since many of the policies and programs that might be considered for analysis could be considered sensitive, it was agreed that respondents would receive whatever level of confidentiality they desired.

LONG-TERM CARE

The first case considered the prospects for local long-term care service delivery in the context of national, state, and local government initiatives. The director of a county agency responsible for a complex array of services to the elderly was approached, and agreed to use the generator to look at possible scenarios for county programs to assist frail elderly and disabled residents. The county's challenge was to supplement and oversee local delivery of federal and state programs providing community long-term care services to frail elderly and disabled county residents as follows:

administration, including -
- case management,
- education/outreach,
- volunteer development, and
- oversight/evaluation of programs sponsored by State and County;

medical, including -
- acute, chronic, preventive programs sponsored by the federal government under MEDICARE/MEDICAID and by the county;

financial, such as -
- Social Security Income applications and appeals,
- county property tax abatement,
- subsidized housing,
- legal assistance, and
- financial counselling;

locally provided direct social services, such as -
- respite care,
- adult day care,
- home care including "activities of daily living" and home chore support,

transportation,
home visits, and
nutrition programs.

This case focused on the prospect of conducting operations in a delivery agency while the outcomes of significant policy decisions at the federal, state, and county level were unknown. At the federal level, the administration's proposal for national health care contains provision for home delivery of medical services. Non-medical services, such as long-term care, may be left to the states and communities to sort out for the immediate future, but are the subjects of continuing debate.

The state legislature has acknowledged the long-term care problem and directed that the state secretary of health and human resources develop and implement a restructured statewide comprehensive management system for long term care. Key to the plan was the consolidation of all state long-term care planning, funding, and management of programs presently administered by four separate state agencies. Much of the operational detail was left to an ill-defined "local option."

The county was in the midst of a significant restructuring of its human services delivery and management system. The concept envisions five "one stop" centers for all human services, supported by staff consolidations, redesigned information systems, and a universal human services intake system.

Since this was the first case, much of the effort was devoted to debugging the program. Scenarios were generated reflecting different external situations, including possible federal and state actions. The primary focus was on the reactions of significant local actors to the initiative at the county level.

The respondent indicated that, although the operational level scenarios were somewhat useful in considering operational adjustments, the potential for significant policy decisions at three levels of government was of greatest concern. Scenarios dealing with federal, state, and local policy decisions would have been highly valued as assisting with her efforts to influence those decisions.

INFORMATION SYSTEMS

The second case concerned a proposed strategic overhaul of a county's information systems - specifically data entry, retrieval, and application development. Software was to be acquired, processes modified, and personnel trained to use and exploit the changed systems.

The county's electronically stored information was fragmented three ways: between mainframe, local area network, and individual personal computer data bases throughout the county. Although standardized products were generated on a recurring basis, the lack of integration, interconnection, and interoperability meant a significant delay and cost in producing any new product for analysis, programming, and clerical efforts.

It was proposed to acquire software, train personnel, and change processes so that staff operations level personnel would have ready access (appropriate to position authority and requirements) to all county data bases. A series of pilot projects would be used to test the proposed policy, at no net cost to the county - using vendor "free trial/beta test" software and support. If the pilots were successful, the Board of Supervisors would be requested to approve software acquisition and training. Costs of full implementation (FY95 and beyond) would be partially offset by savings in maintenance costs of discontinued software, and were estimated at a net of about $30,000.00 per year.

Scenarios were generated which focused attention on possible actions and inactions by the many collaborating agencies and individuals who could impede or speed the process. The practitioner indicated that the scenarios enabled the anticipation of several problems, and the taking of early steps to circumvent these problems.

This case came the closest to highlighting game-like processes. The key obstacle to implementation came from an office which was responsible for acquisition of software and which "owned" the mainframe system. The proposal was initially treated with a "not invented here" attitude. A scenario outlining a series of steps to foster enthusiasm for the proposal by potential beneficiaries was generated and followed leading to acquiescence and the required action by the recalcitrant office. The practitioner indicated a high degree of satisfaction with the process.

NATIONAL SERVICE

The third case dealt with implementation of the administration proposal (now enacted into Law) for national community service. A leading advocate of this program was approached and agreed to comment on scenarios. The legislation, as envisioned and enacted, creates a national community service program, and provides for a minimal program of $300m in FY94, $500m in FY95, and $700m in FY96. No more than 100,000 will participate over the three years of authorization. After two years of service, a participant will be eligible for $9,450 in education benefits.

Scenarios were generated for four alternatives: "no surprises," serious recession/budget cuts, major war, and combined budget cuts and war. The greatest threat to the success of the program was reflected in the competition for recruits by the armed forces in the event of a Viet-Nam type conflict. The practitioner provided comments and suggestions, but appeared to be looking for more surprises.

The respondent expressed a desire for a more expansive set of scenarios, reflecting major trends and events rather than having the focus be on intra-mural administrative conflicts. The respondent indicated that he had been comfortable with the prospects for the implementation of the national community service program. His only concern was with the prospect of some sort of scandal in the program's early stages before it had firmly established a good reputation. The respondent indicated that he was more interested in descriptions of unanticipated future developments which might seriously affect this program.

HAZARDOUS WASTE FACILITY

The first incomplete case began when a group working under a contract with the Department of Energy inquired whether the generator could be applied to the planning for the choice of a major hazardous waste facility site. Their primary concern was the identification of potential intervenors who might enter the site selection process at its various stages rather than the description of the processes which might be associated with the interventions. These intervenors might have included those opposed to a given option such as environmental activists and local economic interests. Other potentially significant actors included politicians with an interest in the economic benefits that might accrue with the locating of such a facility in their district, and businesses who might obtain profitable contractual work from the facility.

Although the generation of generic lists of potential actors was discussed, the identification of actors was not something the generator does, and it was agreed that this would not make a good application.

NATIONAL FLOOD INSURANCE

A Federal Emergency Management Agency official was contacted, and asked if he would be interested in a study of possible reforms to the national flood insurance program. Based on an initially favorable indication, a literature search was conducted. A set of rough-draft possible reform options was developed, and brief, illustrative scenarios prepared for each.

The options included (1) an immediate mandating of full, unsubsidized coverage, (2) a phased program leading to full-coverage, and (3) continuation of the present system which allows many businesses and homeowners to avoid carrying coverage. The scenarios prepared for consideration were focused on the implementation of the options. The set of options and their contexts were meant only to be illustrative of the scenario generation procedure. If the respondent was interested in proceeding, he was informed, specifics of actual options under consideration would be required.

After considering requests for domain and application information, the respondent indicated that the subject was too politically sensitive for him to proceed. He indicated that the level of interest by the Congress, the General

Accounting Office, and others was high. The Federal Emergency Management Agency was about to undergo a reorganization, and there were multiple reviews and evaluations in progress. He felt that he could not afford any time commitment given these other requirements, and he was concerned that his support of yet another study might not be appreciated by his superiors.

REGIONAL TRANSPORTATION

The staff director of a multi-county planning agency was approached, briefed on the generator, and asked to participate in applying the generator to regional transportation policy. The agency is chartered by the state to coordinate land-use planning for a mostly rural area. The agency's work is largely financed by reimbursements from the member counties for services rendered. A small amount of support comes from the state. The region is facing a high probability of rapid and dramatic change as development moves out from the nearby metropolitan area. In order to accommodate growth, a substantial investment in the transportation infrastructure will be required. Regional coordination of county plans for transportation appeared to be high on the agency's list. It was suggested that scenarios of a proposed extension of a nearby light rail system would be interesting.

The director indicated an interest in determining the "value added" of the agency. Specifically, he was interested in placing a dollar value on the strategic benefits which the agency provided to the state. He indicated that although the counties seemed to have an appreciation for the agency's contributions, they had only limited resources. The state government did not share the same appreciation, but does have the potential to be a stable source of increased funding.

Since the proposed application was distant from the problems of policy/program implementation, we decided not to proceed.

THE ELECTRONIC UNIVERSITY

In response to an inquiry, the impacts, out to the year 2012, of two emerging technologies (interactive, 500 channel TV and the interactive multiplayer) on the educational, research, and public service efforts of the university were considered. The question was rephrased as "what are the long term prospects for state institutions of higher learning?" given possible developments in technology, economics, and forecast demographics.

Following a literature search, a first draft scenario was prepared. This scenario consisted of calendar events, as described in the previous chapter, depicting the introduction of certain technologies to university teaching and research and selected economic and demographic milestones.

The respondent indicated that the scenario was interesting, but he raised three concerns which this scenario generator could not handle: (1) that the scenario barely touched the surface and probably 10-20 scenarios would be needed to get thinking going, (2) the scenario lacked the quantification needed to give a feel for the magnitude of events, and (3) in 2012 there could be some things as yet unknown that the scenario generating process would have to invent.

Unfortunately, this scenario generator is not very creative, and cannot handle these concerns immediately. The generator requires information about the domain in which a given policy or program is to be implemented as well as information about the policy or program application of interest. What it could do is to examine the processes which might develop when implementing a given option for the university in a given context. The desired 10-20 scenarios could be the result of the examination of, say, 4-5 options against 5-4 domains.

Based on the foregoing, it was decided to defer work on this subject to some future date.

PARCEL POST

The policy of the United States Postal Service for the selection of transportation mode (truck versus rail) for long-haul parcel (class IV mail) movement was considered. The United States Postal Service is the oldest civilian public service in the United States, and traces its history to the first colonies. The United States Postal Service is, under the Postal Reorganization Act of 1970, a government- sponsored private corporation overseen by an eleven member Board of Governors. Most parcel post flows through two of the 21 service centers, known as bulk mail centers. Packages sent to addresses outside of a local post office's area are moved by truck to the area bulk mail center where they are sorted, and those destined for post offices within the service area sent to those destinations by truck for delivery. Those destined for another area are sent to the appropriate bulk mail center for onward movement to a post office.

The transportation of parcel post between bulk mail centers may be by truck or rail, and the issue to be resolved is whether to continue to use both modes or to switch to truck transportation entirely.

Moving parcel post by rail generally takes more time than moving it by road since trains take more time to reach their destination. Further, the trailers to be "piggy-backed" are often left at the loading dock longer to ensure full loads, and because of the additional time required to (1) to move the trailer to the rail yard and load on the rail car and (2) to unload the trailer from the train and move it to the bulk mail center at the other end.

Truck shipment is usually faster and generally more reliable in the sense of making the contracted delivery window, but rail is less expensive. Further, rail transport does less environmental damage than road, and is more energy efficient.

The trucking companies have a politically powerful association, while the railroads, being fewer in number at present, have a lobbying arm with less cohesion.

After discussion with the respondent, it was agreed that this was a policy choice question rather than one of implementation. Although the decision would stimulate significant interest group maneuvering, it did not appear to present an implementation challenge, and the case was not pursued.

MILITARY BASE CONVERSION

A second regional planning agency was approached with a proposal to generate alternative scenarios for the conversion of a military installation to civilian use. At the time, it was known that a small military base in one of the counties that made up the region was to be closed. The base was located in a rural area, and its conversion will affect that county's economy substantially. The conversion also will have some impact on neighboring counties.

Based on what appeared to be a favorable reaction by the agency director, a literature search on other base conversions was conducted. Based on the case histories of several other base conversions, options for utilization of the property were drafted. A list was prepared of obstacles these conversions faced and how they were dealt with. This material was provided in a second meeting. Shortly thereafter, it was announced that a major restructuring of the regional planning system was being considered at the state level.

Although lively interest was displayed, the agency director declined requests for further meetings.

SCHOOL DEVELOPMENT

A school principal was approached in regard to generating scenarios for a contemplated long-term development plan. The school in question was a parochial elementary and junior high school in a large suburban parish. The area in which the school is located has seen very rapid residential and commercial development. The corresponding public school district is in the process of expanding to meet the demand from the rising population, but has not been able to keep pace without extensive use of temporary facilities. Several new public elementary and middle schools are either under construction or in the planning process.

A $2,000,000 renovation of the parochial school is to begin in the Summer of 1994, but the school capacity is not being expanded. The school currently has lengthy waiting lists for each grade. This is in spite of the recent opening of a new parish with its own school which took the southern third of the older school's area. The Diocese is contemplating dividing the current parish into three, and opening parochial schools with the two new churches.

Initially, the principal expressed an interest. However, after examining a first draft, "no-surprises" scenario, declined to pursue the matter immediately. Apparently, she felt some reluctance to discuss possible long-range plans in public until the renovation mentioned above was underway.

Subsequently, a long-range development planning committee has been formed, and asked to consider the prospects for the next five to ten year period. This committee's study, under the guidance of diocesan officials, will take a year to complete. At some point, it may be worthwhile to consider using a scenario generator to look at possible futures for this situation.

TEST ISSUE ASSESSMENT

What follows is a tabulation of the assessment of the issues and criteria set forth in the test plan contained in chapter 3.

ISSUE 1. Does the program generate event sequences which mimic the dynamics of real world processes?

CRITERIA 1.1: Events, of the various types, are listed in the scenario at the appropriate time.

STATUS: Met. The generator does operate to produce script-like scenarios, and does reflect the ways events could unfold in a given situation. However, the output is totally dependent upon the data files which the generator manipulates to produce its product. A major limitation encountered was that the size of the computer restricted the size of the data base, and precluded exploration of an alternative approach.

ISSUE 2. Does the program generate plausible scenarios?

CRITERIA 2.1: Knowledgeable professional practitioners state that scenarios generated by the model are at least possible, although not necessarily likely or desireable, sequences of future events.

STATUS: Met. This too was a "sure thing," since the analyst made such data base file modifications as were required to achieve plausibility in each case. All of the practitioners agreed that the scenarios were reflective of possible futures.

ISSUE 3. Does the procedure have utility in planning and executing policy implementation?

CRITERIA 3.1: Knowledgeable professional practitioners state that scenarios generated by the program have some utility in planning.

STATUS: Not met. One practitioner, who actually employed the procedure, unequivocally agreed that the process had utility. A second felt that its focus on administrative obstacles was misdirected, and that the prospects presented by significant future developments were more important. The third found the generator interesting, but focused on complexities presented by the flux in what would be the "final" policy decisions at the national, state, and local levels affecting the program of interest. A number of practitioners felt that policy/program implementation was less significant than more fundamental issues, or that the assistance which the generator might provide was not worth the risks to their efforts.

ISSUE 4. What are the user-visible shortfalls in program design and data base content?

CRITERIA 4.1: Knowledgeable professional practitioners suggest obvious additions and/or deletions to/from program data base.

STATUS: Met. Another "sure thing" since data bases were custom tailored to each case.

CRITERIA 4.2: Knowledgeable professional practitioners suggest obvious problems with program processes.

STATUS: Not met. Participants were not in a position to comment on more than the products of the scenario generation process, and consequently could only comment on the end product. More than a little unease was detected that the system did not aim at the challenges that the participants felt were of the most concern.

SUMMARY

As was known at the start, any number of plausible scenarios for the implementation of various alternatives could be produced manually. However, this is a time consuming, labor intensive task, which is not feasible in many contexts.

The program does work, and can be employed to quickly generate alterative scenarios. An "up front" investment in preparing and editing data bases pays off in rapid production of scenarios later. Before the generator can deliver a scenario, domain specific data in the form of event statements and their causal and temporal relationships must be specified. The generation of subsequent versions of the desired set of scenarios wwas facilitated by the generator, although no attempt was made to measure what amount of effort was saved. The three methods of introducing events not only correspond to Thompson's theory[1], but also provide a computationally convenient means to manage the scenario writing process.

The generated scenarios were regarded as plausible, but only after repeated, analyst-manipulated, iterations assured that either user-perceived impossibilities were purged or practitioners came to accept that a particular event sequence was a real possibility.

The scenarios had some level of practical utility. Where the user was concerned with anticipating the details of complex chains of future events as opposed to either the "known-unknowns" of major political decisions or anticipating "unknown-unknowns," they seemed to appreciate the capability to make explicit possible sequences of those future events.

There is also some hint that the process served to clarify, for the users, the limits to what could be foreseen, and this insight was helpful in putting bounds on their planning.

ENDNOTE TO CHAPTER 4

1. James D. Thompson *Organizations in Action: Social Sciences Bases of Administrative Theory* (New York: McGraw-Hill, 1967), pp. 54-55.

CHAPTER 5 - CONCLUSIONS

This dissertation has examined an approach to how artificial intelligence, computer modeling, and scenario writing might contribute to better policy implementation. The literature on policy implementation offers many insights, but is often abstract and contains conflicts which are left to the implementor to resolve. It was hoped that techniques of computer supported scenario writing would provide a practical guide to implementation planning and management.

As an exploratory effort to demonstrate the feasibility of a computer-supported procedure, field trials were limited to a small, "convenience"[1] sample. Consequently, the supportable conclusions are limited. However, what is essentially a collection of anecdotes does permit some inferences worthy of comment. As Hoaglin notes, the research case study is a method for learning the "right" questions to ask.[2] The issues which follow are closely intertwined, but we will consider them under the headings of generator design, data base structure, scenario writing and use, and public policy and program implementation.

GENERATOR DESIGN

This generator was developed and run on what is, by today's standards, a small machine with an Intel 80286 processor and 512 kilobytes of memory. The limitations of memory size constrained the capacity of the generator to handle applications with extensive text files and large pattern response matrices. Given the capabilities which might be brought to bear, some of these limitations might be overcome by brute computing power and newer technologies, although the available system was adequate for the cases which are reported here.

Second, concerning software, or really the algorithms making up the so-called field of "artificial intelligence," it became clear that extent methods might be somewhat useful, but not up to much of the advertising and what was once the popular perception.[3]

Although, it was assumed that:

> By the skillful application of statistical methods, coordinate transformations, and mathematical analysis, any complex, unpredictable dynamic system can be mapped into a simpler, predictable one.[4]

There was no assurance that this mapping will have utility in the context of an effort to forecast future sequences of events. Once "a simpler, predictable" system is itself subjected to analysis, the result has to be mapped back to the "complex, unpredictable dynamic system" of the practitioner's environment. Further, gaining rudimentary understanding of the dynamics of administrative/political activities in a specific case proved difficult.

Halachmi observed that in the public sector, goal definition represents a compromise whose attainment is possible only through the use of vague language and ambiguity. Hence, while in the private sector managers are free to develop strategic plans following resolution on goal statements, public administrators have a long way to go before actual planning can begin, and certainly before they can move from planning to implementation, because in the public sector lobbying and efforts to influence do not end with enactment of a law or approval of a program. Court challenges, attempts to influence interpretations and appropriations, and implementation - never stop.[5]

Third, and as noted earlier, the generator program operates on formatted text files. A set of files, which define the domain of interest with their accompanying key words, are identified. The generator reads these files, substitutes keys for the key-words, and stores the events according to event type. An application file of events is read in similar fashion. The generator creates a script-like scenario of events based on the calendar, the planned schedule of events, simple stimulus-responses, and pattern responses. Key-words are read from the application key-word list, and the specific words are substituted back for the keys when the scenario is displayed. All of this was done to provide some way of getting from the specifics of linguistic depiction of real events to generalized statements of a causal nature, and, when the scenario was generated, back to specificity. There are severe limitations to this approach, as Mallery notes:

> Semantic perception is the process of mapping from a syntactic representation into a semantic representation. Traditionally, universalist semantics advocates determining equivalent meanings (paraphrases) through the decomposition of different surface forms to a canonical semantic form composed of semantic universals, such as "conceptual dependency" primitives. But, lexicalist semantic theories argue that most meaning equivalences must be determined constructively for specific linguistic communities (or even individual language users) and dynamically for the intentional context. Experimental psycholinguistics supports the lexicalist position.[6]

Put another way, we may read a number of meanings into a given text statement according to the immediate circumstances. A computer can compare only ones and zeros. It should be clear, therefore, that it is unlikely that a scenario generator can be constructed which can deliver plausible products without substantial human involvement at one or more points in the process.

This is not to say that the process is without merit, but rather that, given the nature of language and the limitations of present or likely future technology, any such generator will be an assistant to human planning and problem solving rather than a device which provides unambiguous, detailed guidance automatically. The user will have to specify, as a minimum, what the scenario is to cover, at what level of abstraction, provide some level of case-specific inputs, and reflexively determine what are the meanings in the output statements about the situation.

DATA BASES

The complexity of describing any interesting sequence of future events can be daunting. However, computers demand simplicity. The compromise data structure of actor-act-prop has difficulty dealing with common discourse about public activities. For example, how to deal with complex statements, such as:

> Senator Doyle today introduced an amendment to the Surface Transportation Bill which would require that the manufacturers of potentially toxic materials label the material containers used in interstate transportation with the contents of the container and standardized warnings as to the nature of the hazard presented by the contents.

We might understand, but fitting the nuances of the above into a data structure of actor-act-prop without a substantial loss of information is another matter. Alternatively, we must concede with Allen that there is presently no computational theory of action that is sufficiently powerful to capture the range of the meanings and distinctions expressible in English.[7]

If a way is found to capture complex statements, the problem of generalization or stereotyping remains. Assuming we have an extensive data base of examples, in the above format, which we use to train a pattern response matrix, slight variations in a word or phrase (which we accommodate in routine discourse) may result in implausible outputs. Consequently, a method of simplification using key words for stereotyped actors (which captured actor role or purpose) and props, and of simplified predicates was selected. This approach requires a human agent to reduce complex statements, like that concerning Senator Doyle above, to the form required by the computer's processes.

This does not even get to how to do quantitative manipulations of such things as budget numbers, or the other statistics and quantitative measures so common to the practice of public administration. Manipulating this sort of information, handled routinely by spreadsheet programs and integral to business scenarios, is beyond the reach of the methodology outlined in this paper.

SCENARIOS - WRITING AND USING

The process of scenario generation, requiring the in-depth, machine supported, interaction of the scenario-user and the analyst, is a process of creation of a possible future reality. The degree of user agreement with the reality read into the prepared scenario is simply another way of stating plausibility. Judgment is required in the creation of the domain and application information files and their associated key indexes, and the reading of the output scenario. The former has already been mentioned, but the question of how the scenario is read is also of interest.

The level of generalization is a critical scenario design choice. This effort was aimed at maximizing the specificity in the detail displayed in the scenarios. The design of the generator intended that the resulting scenarios were not to be another source of ambiguity. Oracles and soothsayers are at the opposite extreme. The priestess at Delphi, the I Chin, and others give their counsel in the form of opaque messages which the user must then reflexively interpret and apply to the problem at hand. However, we have had warnings, since Euripides, about the dangers of turning improperly to sources of vague and ambiguous guidance:

> The wisest men follow their own direction
> and listen to no prophet guiding them
> none but the fools believe in oracles,
> forsaking their own judgement. Those who know,
> know only that such men can only come to grief.[8]

There will always be some distance between the printed words of a scenario and the meaning the user creates in the process of reading those words. This gap must be reflexively bridged by the user, and suggests that the level of specificity in the presented scenario should be tailored to the nature of the problem. Users who are concerned with the potential impacts of general trends or major choices can use a tool such as the one described here as well as those concerned with the comparative minutiae of administrative events characterizing the task-level implementation of a public program.

An obvious step along this line is to develop an expanded set of key word lists covering several levels of abstraction. In principle, users could select the desired level of abstraction as part of their specification of a particular run. This would permit focusing on a chosen level: policy decision, administrative process, management, operations, or tasks.[9]

Most discussions of policy implementation highlight the necessity of considering the involved agencies, apparent and possible stakeholders, and other actors. However, there does not appear to be a consensus on an overarching structure for either identifying stakeholders or establishing the appropriate contextual background for analysis. Many taxonomies have been suggested, but they all seemed to be inadequate when applied to the specifics of an actual case.

For a given case, a practical classification scheme of would be unambiguously applicable and include consideration of such categories and elements as:

functional level[10]
- policy,
- administration,
- management,
- operations;

intergovernmental level
- federal,
- regional,
- state,
- multi-county,
- local;

component
- mission,
- structure,
- resources,
- process,
- product,
- client;

work breakdown

policy,
program,
project,
task;

aspiration perspective
political-representative-responsive,
managerial-economy-efficiency,
legalist-equity-due process)[11]; and

possibly many others.

This structure might provide the basis for the key word list, and lead to a comprehensive model. Such a structure should permit the classification of a given policy, the type-casting of all relevant stakeholders, and the identification of significant potential pitfalls in the implementation process. Attempts to establish the desired, applicable framework from taxonomies contained in the literature[12] as the basis for a comprehensive scenario generator were never brought to closure. Simply put, the gap between statements of accepted theory (if any) and statements of the specific reality of a particular case (however agreed upon) must be bridged by human judgment. It is abundantly clear that a number of perspectives require consideration in any attempt to analyze and assess the implementation prospects for a given policy initiative, but that the available theoretical guidance for practice is inadequate to the degree of precision which is required for a universally applicable computer model. Further, the literature indicates that such an effort will have to deal with such problems as the combinatorial explosion, definitional conflicts, and the tuning fallacy.[13]

Neither the approach described in this dissertation nor any other will ever be able to accurately predict the future in detail. However, scenario writing need not be a black box. Event relationships can be described and modeled as required, at least to forward map (suggest where we are headed, given initial conditions) and to backward map (suggest how to begin, given a goal) as well.

POLICY IMPLEMENTATION

This exploratory effort focused on operational implementation. That is, the scenarios mainly concerned inter-agency processes. A review of the cases and respondents' comments indicates that the respondents were more concerned with other issues. In general, respondents seemed comfortable with their ability to manage, given the requisite resources and clarity of guidance. We cannot conclude that implementation is not an important concern, but the "customer" may be more interested in policy changes, resources, and significant exeternalities.

The scenario approach is consistent with the textbook consensus on the necessity of taking a multi-dimensional approach to policy feasibility analysis.[14] This effort has further served to point out what may best be called the "administrative complexity" of even the lowest level case. However, we should not be surprised to find public servants expressing less concern with these complexities, which they seem to feel they can influence, than with the things beyond their control. Unfortunately, this does not resolve the debate between delegation and centralized control.

If a picture of the future can only be painted with a broad brush, then those who favor the process-orientation have a stronger argument for delegations of `authoritydown the administrative hierarchy and to reliance on market forces for public purposes. While, on the other hand, if it is possible to precisely specify future events, it is then possible to closely direct the future actions to be taken in response to those events, allowing more centralized control of programs - thus enabling and legitimizing state intervention on a broader scope.

Although this research does not end this argument, it does suggest that neither side has a final answer. The process-orientation can anticipate that such tools as this can be profitably employed by planners to achievement of politically selected goals. The planning-orientation will be disturbed to note that no magic bullet has been found, and their challenges remain essentially intact.

ENDNOTES TO CHAPTER 5

1. United States General Accounting Office, Program and Methodology Division Case Study Evaluations Transfer Paper 10.1.9 (Washington, DC: US Government Printing Office, 1990), pp. 34-37.

2. David C. Hoaglin, et al. Data for Decisions: Information Strategies for Policy Makers (Cambridge, MA: Abt Books, 1982).

3. Andrew Pollack "Setbacks for Artificial Intelligence" in New York Times March 4, 1988.

4. Foster Morrison The Art of Modeling Dynamic Systems: Forecasting for Chaos, Randomness, and Determinism (New York: John Wiley & Sons, 1991), p. ix.

5. Arie Halachmi "Strategic Planning and Management? Not Necessarily" in Public Productivity Review 40 (Winter, 1986), p. 42.

6. John C. Mallery "Semantic Content Analysis: A New Methodology for the RELATUS Natural Language Environment" in Hudson, Valerie M. ed. Artificial Intelligence and International Politics (Boulder, CO: Westview Press, 1991), pp. 350-351.

7. James F. Allen "Towards a General Theory of Action and Time" in Artificial Intelligence 23 (1984), p. 123.

8. Euripides "Iphigenia in Tauris" (trans. Witter Bynner), in Greek Tragedies (Chicago: University of Chicago Press, 1972), Vol. 2, p. 137.

9. This hierarchy was suggested by James H. Svara "Dichotomy and Duality: Reconceptualizing the Relationship between Policy and Administration in Council-Manager Cities" in Frederickson, H. George Ideal and Practice in Council-Manager Government (Washington, DC: ICMA, 1989), pp. 53-69.

10. Svara, op. cit.

11. David H. Rosenbloom "Public Administration Theory and the Separation of Powers" in Public Administration Review 52 (May/June 1983), pp. 219-227.

12. Leonard Champney "Public Goods and Policy Types" in Public Administration Review 48 (November/December, 1988), pp. 988-994.

13. Morrison, op. cit.

14. Carl V. Patton and David S. Sawicki Basic Methods of Policy Analysis and Planning, 2nd Ed (Engelwood Cliffs, NJ: Prentice Hall, 1993), pp. 307-313.

CHAPTER 6 - RECOMMENDATIONS

Although this version of a scenario generator is not an polished instrument ready for the hands of practicing policy implementers, the exploratory trials have suggested ways analysts and practitioners might better address problems of public policy and program implementation. Some refinements should improve the efficacy and efficiency of computer supported scenario generation. The following are a few suggestions for generator design, scenario writing and use, and the practice of policy/program implementation.

GENERATOR DESIGN

The basic generator structure employed seemed sound, at least as a first try, but it would be interesting to see what could be accomplished by applying more computing power, greatly expanding the key-words (perhaps basing the key-word dictionary on the Library of Congress's subject headings), and wrapping the enlarged version in an effective user interface. The platform used for the generator was adequate for the limited prototype. However the capabilities of the platform constrained the generator, and exploiting a more advanced machine should permit examining a number of questions which had to be set aside.

Given a more powerful platform, a further step would be to work up a version based on a more comprehensive set of key-word dictionaries, a semantic structure based supporting parser, and exploit further advances in distributed parallel processing. An expanded generator, based on a comprehensive key-word dictionary and more computing power, should enable us to finally confront the questions of whether the combinatorial explosion and/or the tuning fallacy will ultimately frustrate efforts to provide a practical, user friendly scenario generator.

An expanded generator, to be truly useful, should not require the interpositioning of another person between the ultimate user and the process. The system should permit rapid user learning and, if not effortless, then relatively easy employment. As noted in the previous chapter, much of the benefit of this instrument lies in the reflexive interaction of the user with the machine-generated text. Consequently the more comfortable the user is with the instrument, the greater the instrument's potential utility.

SCENARIO WRITING AND USE

Policy and program implementation can be viewed at several levels: the vision of the goal, general strategies, objectives to be achieved in pursuit of those strategies, and specific tactics and tasks. Scenarios are useful to practitioners at each of these levels, but practitioner needs differ in terms of the detail required. Put another way, the focus of the scenario should be matched to the needs of the user. A very general, broad, far-reaching picture of the future can help in clarifying the possibilities for addressing a given problem, while a very detailed scenario might be required to develop specific action plans. A comprehensive generator system should be adaptable to the desired perspective through data file selection. This could be done by developing multiple key-dictionaries from which users may choose while setting up their applications.

If "forward mapped" scenarios project future events from present actions and "backward mapped" scenarios identify present alternatives which could produce a given future state, planning scenario development combines the two. Scenarios can be used to avoid the foreclosed search for viable options, the premature rejection of possibilities, and the suppression of fundamental, obscure problems often associated with the nearsightedness stemming from "muddling through."[1] The power to define what is to be the plausible set of possible futures may be crucial to efforts at organizational change, and may be the subject of conflict in many situations. Just how these conflicts may unfold is beyond the scope of this paper, but should be the subject of further investigation.

POLICY IMPLEMENTATION

Implementation feasibility assessment should be an integral and essential component of the policy analysis process, and should, insofar as that is possible, include even-handed, objective forecasts of obstacles to success. Opting exclusively for either worst- or best-case visions of the process and the consequences of putting some concept to a practical application does a disservice to the practitioner and to the served public. There needs to be an interest by the user and a recognition that the modeling process might provide insights into policy/program decisions that otherwise could not be as easily obtained. Any supporting instrument which proposes to be of some utility must demonstrate that it can provide some perceptible increase in effectiveness of decision making and/or some savings in user time and effort. Information on the performance of alternative strategies needs to be presented in a way that can be easily processed by the user and disseminated to other interested parties.

Creation of a common, master taxonomy as the basis for the key-dictionaries is an unbounded problem in the sense that no matter how comprehensive, there will always be yet other terms to be added. However, a practical scenario generator can be no better than its data, and the list of key words is, in this conception, the basis for the information that the generator employs. Here, at least, we have a case where bigger may prove to be better.

As was noted in the previous chapter, policy implementation may not be as significant a problem to practitioners as the literature suggests. Public servants might prefer better information on prospects for political, economic, social, and other major developments which could impact their programs over game plans for the implementation of a given policy choice. It may be that the factors which are most difficult to predict and control are of greater concern than those which practitioners routinely handle. Some further research into what factors are the most troubling to public servants would seem worthy of consideration, and might serve to direct the application of scenario methodology to problems of greatest concern to the practice of public administration.

Finally, it should be noted that this scenario generation process, while it may not present adequate utility to a given practitioner to justify application to a specific situation, appears to offer more than a little promise as a support to experiential learning for students of administration. Further, it may offer researchers a tool to extract a greater measure of generalizability from case studies than what has been previously possible.

CONCLUSION

In this paper we have looked at the value of computer modeling of qualitative information and scenarios to public policy and program implementation. Specifically, we have tried to show that scenarios have utility to practicing public administrators. I have argued that, while no crystal ball, scenario generators can be a valuable addition to the administrative repertory. While practitioners may regard generating scenarios as a specialized activity and beyond their scope, we have seen that the process is not that difficult, and can assist in practical planning and decision making.

However insightful it may be, an unfortunate aspect of the "games" metaphor for public policy and program implementation is the connotation of "winning" and "losing" which often comes with it. While partisan, elected officials may be comfortable looking at processes that way, the administrative facts of life are different. While the electoral process may have wins and losses, policy implementation and program execution are protracted processes where success is always a matter of degree, and sacrificing long term prospects to strike an immediate posture is usually a poor decision. Methods, such as the one described here, may have their greatest utility to the extent that they can edge out some of the reliance on superficialities regarding future prospects with arguments of substance.

ENDNOTE TO CHAPTER 6

1.David L. Weimer "The Current State of the Design Craft: Borrowing, Tinkering, and Problem Solving" in <u>Public Administration Review</u> 53, 2 (March/April 1993), p. 112.

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