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M E M O R A N D U M

INTUITIVE MODELS FOR URBAN POLICY MAKING AND PLANNING

Prepared for Presentation at the
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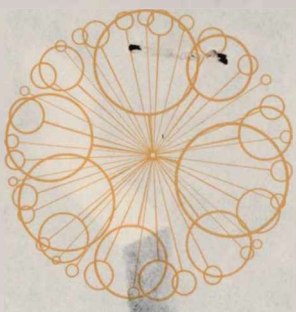

23 May 1969

Dear Ivan

We, my partner Jivan Tabibian and I, see your brother Sacha frequently. We were so involved in day to day crises that we didn't get to try to see you when you were last in Southern California.

We have developed an approach for a basic elementary education program based on transactional experiences, that has generated some interest at USOE. However, our first proposal was too expensive for them--they have become conditioned to paying for the ideas of part time professors in "normal schools" who are, infact, one of the biggest parts of the problem.

I've enclosed a copy of a paper that you may find interesting.

We'd like to come down sometime this summer if we can get things smoothed out somewhat, but possibly we'll just have to accept the fact that things are never going to run by themselves--that may be why there are such things as managers. Also enclosed is a new shorter brochure. As Oscar Wilde once said: "Nowadays people know the price of everything and the value of nothing."

Warmest regards,

D. Sam Scheele

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INTUITIVE MODELS FOR URBAN POLICY MAKING AND PLANNING

D. Sam Scheele
Social Engineering Technology

Before getting to the topic, I'd like to put down some loose talk about our logo at Social Engineering Technology. Rumor has it that our logo suggests that we operate some kind of mystical guru enlightenment emporium in Los Angeles. Such a venture would no doubt be a success. But, "this pleasure has not been mine."

No doubt there are substantive issues which are more fashionably relevant that I could have discussed here; such as, educational innovations, rumor control mechanisms, or more socially responsive housing environments. Discussing a substantive topic might have proved more interesting than this harangue on methodology. Somehow, arming oneself for making substantive expositions usually requires field work and much reading. My aversion to both is well known. Anyway, almost everyone knows more than I about some speciality. This all makes the comparative safety of indulging in methodological manifestos appealing.

Without going into an elaborate description of how I found out the maximum number of individual angels that could dance on the head of a pin, I will introduce my topic with a digression. I recall an observation made by R. Buckminister Fuller -- that there were some important distinctions between the quality of life one could lead with a thousand actual living slaves, and the life we lead with the benefits of our ten thousand energy slaves. The point being that single, or even multi-dimensional quantitative measures are not always descriptive of the critical characteristics of a new configuration or situation. Quantification has certainly led to advances in policy making and planning. However, I must resist

strongly the pseudo-corollary of this statement -- that all "true progress" in policy making and planning will come from quantitative approaches based on numerical data. In this discussion, I will attempt to show the importance and use of models in urban policy making and planning that are intuitive and that deal with largely non-numerical data, but that are nonetheless explicit.

Economist William S. Vickrey of Columbia has observed the need for treating as data nonquantitative information. After a long discussion of structural relationships in his book on models for a dynamic macroeconomics, he states:

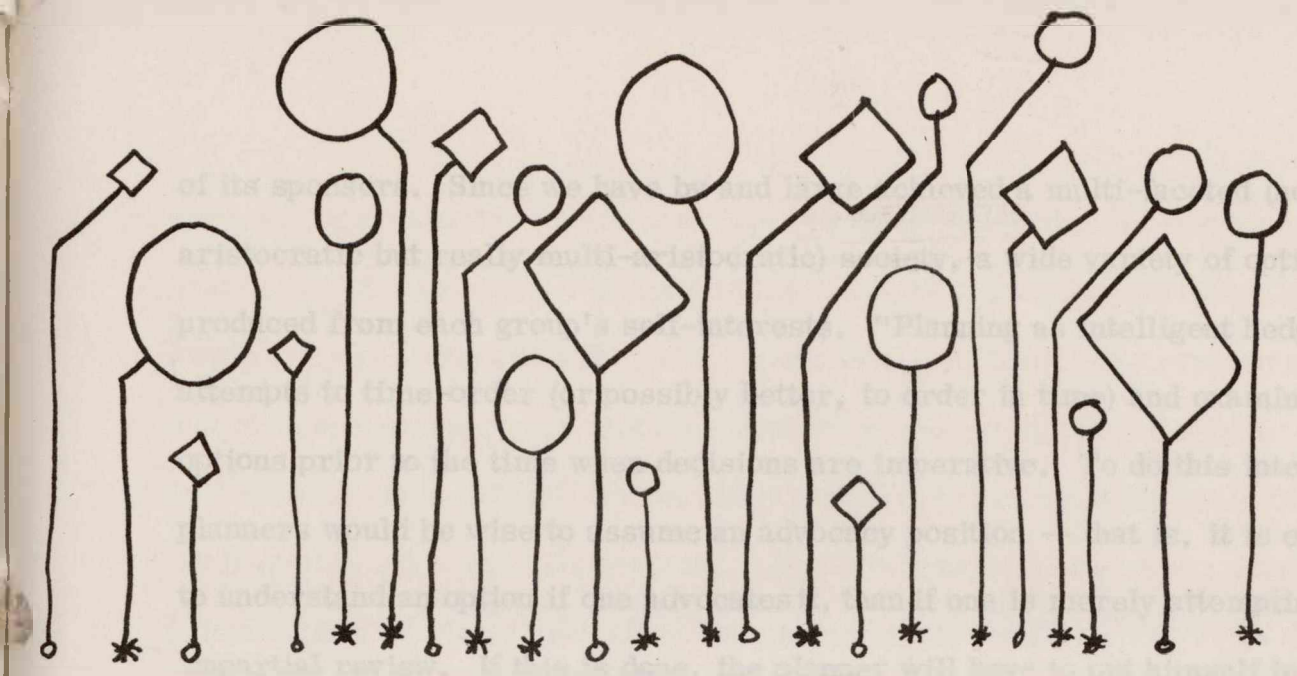
> Converting, this underlying concept of structure into a workable dynamic model is, however, a difficult process unless a great deal is done to simplify matters. To begin with, those who are interested in confronting their models with empirical data have to face the fact that while the data that constitute the experience of firms and individuals can be observed, their plans and expectations are much more difficult to "observe." Indeed, in most cases, it is not the actual plans or expectations that are observed but what individuals concerned can be induced to say about them, which is a different matter. Economists have traditionally been more reluctant to treat verbal expressions as data than have sociologists and psychologists, preferring to restrict themselves to such objective data as prices and quantities.
>
> On occasion, to be sure, even prices and quantities have taken on a nominal character when accountants' valuations rather than market transactions are conceived. Economists are, however, gradually learning to accept statements concerning plans, and expectations, as data worthy of serious attention. But while much has been done in recent years to obtain data on expectations and plans by interview and questionnaire methods, or by examining the internal communications of firms, such data is relatively scanty and often not cast in a form that would be required if it is to be directly interpreted in terms of the concepts of the models. Many models therefore jump directly from experience to action, leaving the intervening expectations and plans without explicit formulation.

To Vickrey's expectations and plans I would add rumors, intentions, rhetoric, and the characteristics of the media as being important elements to treat explicitly in developing models that will be useful to policy makers and planners. But, I will leave the authoritative taxonomy of these information sources for another paper.

Before describing the models, I would like to peddle some ideas on the nature of policy making and planning. I think of policy-making as making comparisons between alternative processes for improvement or change and formulating instrumentalities. I would define planning as intelligent hedging (following Schlesinger) -- that consists primarily of maintaining, shaping, and enhancing desirable options, avoiding awful eventualities, and attempting to keep open to change. I have illustrated this generalized view of the role of policy-makers and planners in the diagram that follows.

I don't understand all I know about this diagram. Although it was adapted from one I made for another purpose, it seems to have gained something in translation. It also seems to fit on the page better. You've all realized by now the drawing isn't self-explanatory. I'm not sure I can explain it. But I am sure that if you explain it to yourself, you'll be more inclined to agree with the explanation of it. Also your explanation of it may differ from mine and thus add to the state-of-the-art, and thus to the merit of the diagram. However, I'll contaminate your objectivity slightly by a discussion that will have some of the same words in it as the diagram has.

New options for consideration in planning are produced by exploration of opportunities and threats in the future. In our present society, this exploration and research is largely carried on informally by interest groups to produce options that will help to consolidate and enhance their positions. I believe this is still true despite the supposedly large government expenditures for research. Because as Knesse and Hirfendahl pointed out, government sponsored research is directed at identifying or evaluating substitutes, and not at producing new alternatives. Some additional options that are produced ostensibly come from research sponsored by organizations that impart minimal "value loadings." But, in practice, most often research produces options that reinforce the predelictions



FUTURES

* opportunities to secure
O threats to avoid

COMPREHENSIVE PLANNER

INTEREST GROUPS
SPECIALIZED PUBLICS
ORGANIZED RESEARCH

IDENTIFY OPPORTUNITIES & THREATS

FORMULATE RESPONSE OPTIONS

ESTABLISH PRIORITIES & REVIEW GOALS and OBJECTIVES

DEFINE RESPONSE OPTIONS

CREATE OR INFORM INTEREST GROUP TO PROPOSE RESPONSE OPTION

MAINTAIN SHELF-STOCK OF PLAUSIBLE OPTIONS

SYNTHESIZE DOCTRINE and MONITOR CONTROLS & BALANCES

CONDUCT DEMONSTRATIONS TO TEST EFFECTIVENESS OF ALTERNATIVE RESPONSE OPTIONS

DEVISE PROGRAMS

Possibly utilize multiple approaches

Explicitly define the new programs

Time phase program from IMPLEMENTATION throught EFFECTIVENESS to RETROGRADE and REPLACEMENT

Begin Looking for Options to Replace Programs Just Started

OPERATING SERVICE & PRODUCT DELIVERY SYSTEMS

of its sponsors. Since we have by and large achieved a multi-faceted (not anti-aristocratic but really multi-aristocratic) society, a wide variety of options are produced from each group's self-interests. "Planning as intelligent hedging" attempts to time-order (or possibly better, to order in time) and examine these options prior to the time when decisions are imperative. To do this intelligently, planners would be wise to assume an advocacy position -- that is, it is easier to understand an option if one advocates it, than if one is merely attempting an impartial review. If this is done, the planner will have to put himself in the role of advocating many diverse positions in order to understand or become knowledgeable about what could be done today to preserve that option for the future, and when the time would be appropriate to exercise the option. In the case of threats, the planner asks what can be done tomorrow (or the day after) to reduce the likelihood of, or to mollify, the effects of a particular threat in the future. This is not to say the options that planners are aware of are not often in conflict. They are, and it should be recognized that it is not always to the advantage of the planner to resolve these conflicts among potential options immediately. For this reason, people who engage in intelligent policy making and planning will fare better if they have a high tolerance for ambiguous situations. More pluralistic and less doctrinaire programs can only be realized through an open-ended approach to planning.

I believe planners are responsible for the keeping of an organized shelf stock of options for the future, and for directing their efforts in the present to preserve the opportunities, and attempting to reduce the possibility and the potential effects of threats. Planning is not "doing" in the sense of implementing any of the options. However, a planner with a well-developed shelf stock of options will always have two or three alternatives to sell to any particular interest group. A planner may, in fact, ask a variety of groups to try

competitive demonstrations of their options at the same time to test them in practice. Planners do not bargain in the sense of playing off one specific alternative against another to achieve a compromise. Instead, planners can allow and even encourage rivalry between options because in the process each option will become more refined, and possibly conflicts between expectations can be averted which is easier than waiting to resolve incompatibilities in practices. If the number of plausible options can be reduced by healthy rivalry, then at some point in the future it will become less and less necessary to take action to resolve the differences by unwise, but expedient, compromises between concrete alternatives with a day-after-tomorrow time horizon. Thus, attempting to shape-up the world of expectations can lead to a more orderly implementation of the programs that are derived from these expectations. To look at this another way, shaping up expectations is the bit in the horse's mouth that leads the whole animal, and can be more effective than recourse to the whip in attempting to shape behavior.

As you know, very few organizations go about policy making or planning in the way I have described above. However, I believe that if they did, they would be more potent in shaping their future; I'd feel more optimistic about the results; and I am sure I'd understand what was being attempted -- which is not true for the practices that are currently undertaken as policy making and planning. Presently, policy making is generally a euphemism for setting limitations on the means that could be used to reach desirable objectives, and possibly a shopping list of what objectives are legitimate. Planning usually consists of statements on how to reach some of these objectives using the O. K. means in anywhere from 3 to 300 steps covering a period of about 5 years. Preferably these next five years should be similar to the past five.

The distinctions between what I call policy making and what I think others view as policy making may never be clear. However, in planning, Schlesinger has made a very helpful dichotomy between "Cook's-tour-planning" and Lewis & Clark planning. Cook's-tour-planning rests explicitly or implicitly on the supposition that the dimensions and direction of the future can be sufficiently inferred to be able at least to specify a commitment and to chart achievement milestones and criteria. By contrast, Lewis & Clark planning acknowledges uncertainty, and suggests that neither the size of the commitment nor the direction of movement should be charted too far in advance. Despite its messiness, the relative advantages of Lewis & Clark planning increase as uncertainties, and/or policy makers' awareness of them, become substantial. It should be remembered that in all big organizations there are strong pressures to make large commitments in a quest to produce "good" Cook's-tour-planning. This is because of the difficulty and cost of communication, the need for cohesion, and the urge by those in power to commit others to their view of the world, their objectives, and their strategies.

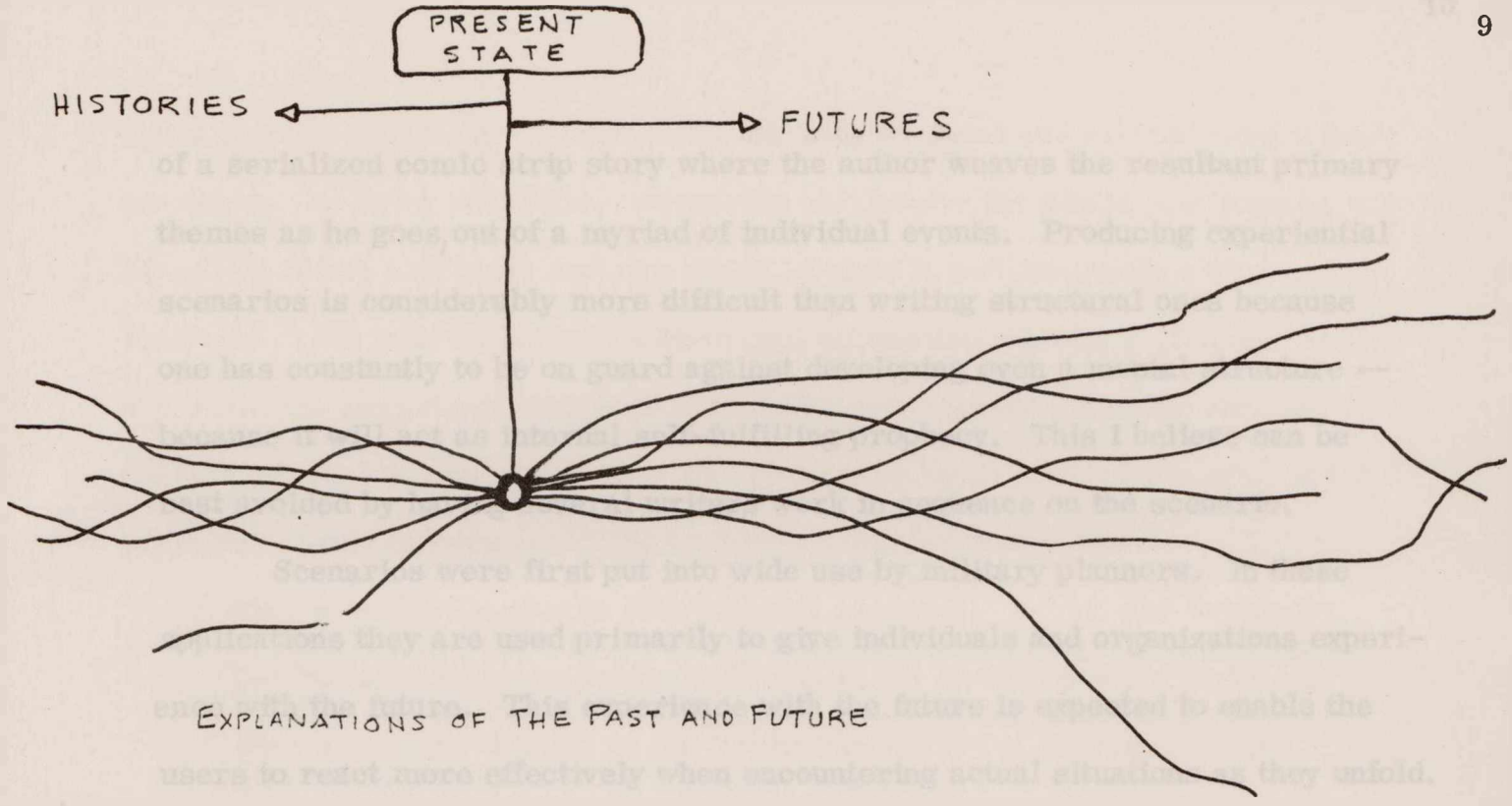
Since this paper isn't going to settle the issue of what is the right way to go about making policy, nor can I present even an orderly table of contents for a new syllabus on the planning process, let me define what I mean by intuitive models. Most simply, intuitive models are schemes that structure intuitive information or that have structures that are largely derived by intuition. The list of models that I will describe was intended to be inclusive, but obviously I've missed some, and other models are yet to be invented. (Possibly even someone will classify them differently and change the number of classifications.) Along with a description I have indicated some of the applications that I see for these intuitive models. However, if these kinds of models are going to be genuinely useful and convincing in promoting positive adjustments to urban change, then the

number of new applications will have to increase faster than the number of models -- which hasn't been true in related fields. If every application were a pin, then the number of models for each application seems to have been roughly equivalent to the number of angels that could dance on it.

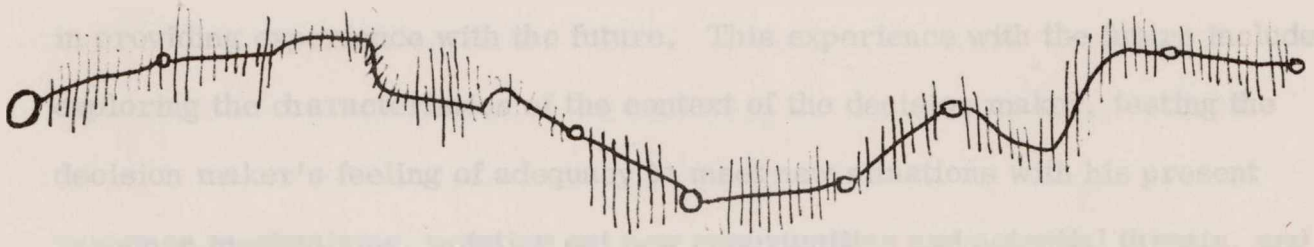
SCENARIO WRITING

The verbal construct is probably the most elementary kind of model. In an average day, you probably construct 15 or 20 of these simple models. A scenario consists of merely linking together a series of verbal constructs into a plausible chain of events. For any situation there are a variety of possible explanations of how that situation came to be or histories. We would expect that these histories would diverge in the more distant past -- that is with remoteness in time a wider variety of situations might be linked by a chain of plausible events to the present. Now, looking forward from a particular situation, one can always postulate several plausible types of transformations leading to different situations in the future. As these chains of events move from the present farther into the future, a greater number of plausible resultant situations are possible. Each one of these plausible chains of events is called a scenario, or "future."

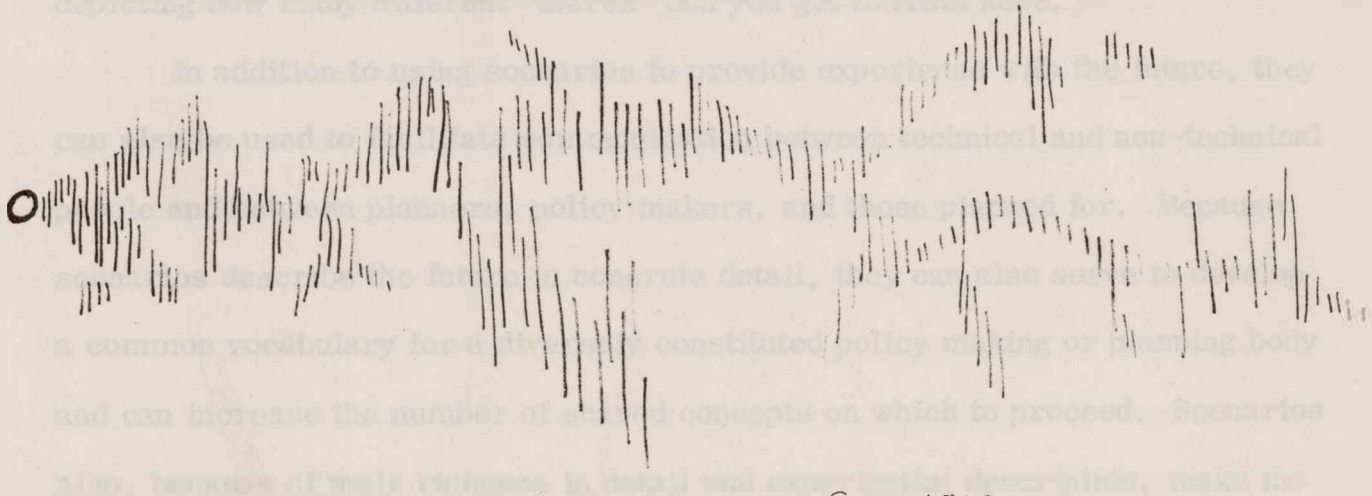
Up to the present time most of the scenarios that have been constructed are what I shall term structural scenarios. These scenarios are structural in nature because the fleshing out of the life-like details that give scenarios their quality of being able to experience the future have been attached to abstract and causatively linked projections. Another type of scenario, that I will call experiential scenarios, can also be constructed. The formulation of an experiential sceanrio differs from the structural scenario by avoiding the structural step of making abstract causative thrusts to lead the way into the future, and begin with a mass of concrete detail. The process is somewhat like the development



EXPLANATIONS OF THE PAST AND FUTURE



DEVELOPMENT OF A STRUCTURAL SCENARIO



DEVELOPMENT OF AN EXPERIENTIAL SCENARIO

of a serialized comic strip story where the author weaves the resultant primary themes as he goes, out of a myriad of individual events. Producing experiential scenarios is considerably more difficult than writing structural ones because one has constantly to be on guard against developing even a mental structure -- because it will act as internal self-fulfilling prophecy. This I believe can be best avoided by having several writers work in sequence on the scenario.

Scenarios were first put into wide use by military planners. In these applications they are used primarily to give individuals and organizations experience with the future. This experience with the future is expected to enable the users to react more effectively when encountering actual situations as they unfold. Scenarios in military planning are used primarily to explore topics where actual experience or simulation would be impossible. Probably the chief value of scenarios for urban policy making and planning is the usefulness of scenarios in providing experience with the future. This experience with the future includes exploring the characteristics of the context of the decision maker, testing the decision maker's feeling of adequacy to meet new situations with his present response mechanisms, pointing out new opportunities and potential threats, and exploring the implications of new means for response. This basically entails depicting how many different "theres" can you get to from here.

In addition to using scenarios to provide experience with the future, they can also be used to facilitate communication between technical and non-technical people and between planners, policy makers, and those planned for. Because scenarios describe the future in concrete detail, they can also serve to develop a common vocabulary for a diversely constituted policy making or planning body and can increase the number of shared concepts on which to proceed. Scenarios also, because of their richness in detail and experiential description, make the various considerations of the future accessible to a wider variety of people than

would concern themselves with more technically oriented and narrowly described forecasts. By being accessible, scenarios can involve the public emotionally, act as self-fulfilling prophecy, and in a sense be used to sell the public a future. This may prove very useful. The historical economist, George J. Stigler, has described the importance of tracts and hucksterish approaches to the success of the economists and economic ideas that are now recognized as important. In the same way, practical utopias might be "sold." Stigler comments:

> New ideas are harder to sell than new products. Inertia and the many unharmonious voices of those who would change our ways combine against the balanced and tempered statements of the merits of one's "original" views. One must put on the best face possible, and much is possible. Wares must be shouted -- the human mind is not a divining rod that quivers over truth.

Based on George Miller's suggestions of post-reward/punish behavioral manipulation techniques, another potentially important use for scenarios can be made. Miller suggests that behavior can be modified by providing people in advance with models of how others will respond to their actions. Awareness of this normative model of how others are likely to respond almost insures the following of a program portrayed as successfully received, or the avoidance of those programs that have been depicted as ineffective. Scenarios could thus be used to influence the response to a particular recommendation.

A report, for example, could contain a section describing different responses that the writers could imagine the report producing. This information is almost always developed, at least crudely, by authors anyway. Often a policy making or planning body has some notion of how its constituents will respond to a particular finding, but does not know very clearly how it would like them to respond. Usually the response that they want to avoid is the snap of the fingers, off the shelf, "OK this is what we gotta do next," reflexive, kind of action that is too available. To avoid this reflexive response, one might present a scenario,

or series of scenarios, showing how the reflexive response if attempted will compound or confound the situation. This might be followed up by showing how even two or three additional refinements of the reflexive response that one might turn to, after learning of the allegation that the reflexive response was inadequate, also could lead to further difficulties. One could leave the discussion at this point. However, it would also be possible to illustrate with scenarios two or three approaches that could hopefully lead to better situations, but not offer any guarantees of the success of these approaches.

CONTINGENCY MODELS

I suppose that what I call contingency models are somehow related in concept to the stochastic investment models that financial analysts have developed and in function to the sensitivity analysis routines that researchers use to test their models. Contingency models can be used to make probabilistic forecasts or to test proposals. To construct a contingency model one first needs a catalog of contingencies. The future is inhabited by many contingencies, and those most relevant to the situation must be identified and described. This will usually involve intuition. Great precision is not the point, because richness of content rather than rigor of analysis is the main point. A contingency model generates a great number of stochastic or probabilistic simulations of the future. These simulations, usually developed by a computer, are used to either test a proposal by keeping score on the number of violations of the limits of the proposal, or are scored for each dimension under consideration to provide probability distribution forecasts of the results -- such as in middle 80% of the simulations the maximum sixth grade population in a district was 23,628 and the minimum was 17,435.

For use in the model an identification must be given each contingency, and its links with other contingencies that it will, or might, trigger must be

specified. Next the impact of the occurrence of each contingency on the dimensions of the simulation must be intuitively described. A stochastic model can be used or the subjective probability of the occurrence of the contingency can be specified, either for each year under consideration, or as a function of the cumulative probability. The final requirement is a description of the present situation in the dimensions that will be simulated by the model. This description can be either entirely factual, based on observation and intuitively interpreted, or entirely a hypothetical fabrication of a plausible situation to test the effectiveness of a proposed intervention.

Contingency models rely almost entirely on the capabilities of the computer to make a large number of individual simulations of the future and then analyze the results. In the contingency model the initial state or present situation is allowed to be modified by a stochastic or probabilistic stream of contingency events that have been identified as inhabitants of the future. Each individual future is iterated, and a summary is presented and analyzed on those futures that fall within the range that the policy maker or planner has specified as critical. The questions that can be asked of a contingency model are of the following type. In the middle seventy-five percent of the possible futures, what is the greatest demand for library services; or how adequate is the proposed microwave communications system for the next ten years.

Contingency models are particularly useful in testing ideas in terms of confidence levels about the capacity of different elements of a proposed system that will encounter potential demands that are too fluid for precise numerical analysis. This occurs frequently when status, attractiveness, and fashionability strongly influence demand, such as in transportation systems or shopping facilities. Engineers use similar criteria when they design for 10 or 25 year storms. Also contingency models and their development can limn those areas where it might be valuable and possible to secure more information to reduce the

uncertainty of particular contingencies, or to suggest inquiry routines that could be used to monitor important contingencies in terms of their indicator events.

COLLECTIVE MEMORIES

I was first introduced to the explicit notion of collective memories by Geoffrey Ball of Stanford Research Institute. Collective memories exist in many forms, including the minutes of almost every business meeting. However, few of these rudimentary collective memories are very useful because their review, summarization, and the retrieval of specific information is laborious. One type of collective memory consists of a series of graphic constructs of the process of a discussion or debate. Periodically throughout a meeting a summary can be made from the memory to indicate what has transpired. In this way collective memories can preclude the reiteration of rhetoric, and can often promote the synthesis of structure.

People identify strongly with graphics. By representing ideas and linkages in graphic form the sense of progress of a meeting can be increased and a written summary of the results is more likely to be agreed upon. This is particularly helpful in a series of meetings to avoid covering the same ground again with very little substance being added. Graphic group memory devices presently are highly dependent on the skills and experiences of the recorder. Attempts could be made to provide a more explicit guide so that the skill could be acquired from a manual and test exercises. In the future, the recorder's role will possibly be computerized with a large visual display. David Evans at SRI has been very successful in related work. This will make long distance conferencing a productive possibility.

Another type of group memory can be very useful to keep track of subjective observations in conjunction with the contingency models described previously. In most cases policy making and planning bodies have a great deal more

valuable information about their environment than is recorded and utilized. This is because of the fact, that after the information has been identified, men are poor information processors. As Ward Edwards and others have shown, men waste 50% - 80% of the information available to them. But, this will be the topic of the section on probability synthesizers.

In the proceedings of most policy making or planning bodies a lot of information in the form of intuitive perceptions could be collected to be used in the analysis of future situations. However, generally most of this information is lost (1) because it was not perceived as valuable at the time and (2) because it is buried in the minutes of the meeting, if it is recorded at all. Often members of these boards could easily supply this kind of information, but it is never solicited and thus it is lost. If contingency surveys of the policy making and planning board are solicited regularly, it not only provides much data that can be used in analyses and to refine simulations; but collecting their perceptions can provide the members with an increased sense of importance. The act of collecting their perceptions can also defuse board members by providing an outlet for them to say their piece about their observations without having to direct it at anyone or at any of the proposals under consideration.

Forecasting Recipes

I use the term forecasting recipes to describe the intuitive framework and conceptual constructs that are the basis of most forecasting models. Forecasting recipes differs from contingency models in that they deal with more precisely defined dimensions of a situation that have been selected as a priori important to policy makers or planners. Bertrand De Jovenel's work, "The Art of Conjecture," is a good discussion in this field. Helmer and Rieman's "Delphi Technique" for the systematic interrogation of experts also probably fits into this scheme, although

it could also be classified with the explicit group formats. There are as many forecasting recipes as there are imaginations, and I would not seek to limit the bounds of this domain by a narrow definition. All forecasting schemata are based on one assumption, that is the same as Maxwell Smart's "would you believe."

In working with a group, it is probably easier to get consensus on methodology than it is around substantive issues. Therefore, the strength of forecasting recipes lies in their methodological rather than substantive base. Because, having agreement on methodology, makes one party to the eventualities obtained.

Forecasting recipes are often used to test policy implications, or to explore how processes over time might lead to certain eventualities. In fact, I would say the single most important product of forecasting recipes is to produce eventualities for consideration. Because depicting an undesirable eventuality can prompt intervention.

Being intuitively based, there is often much controversy about the assumptions made in forecasting recipes, but this is generally technical. If they once get into the media, then debates about them take on a religious connotation where adherents both to them and against them are not going to be convinced by rational arguments. This is the case presently with many of the doomsday population forecasts. Generally speaking, forecasting recipes are stronger policy and planning tools where they follow, or are related to, the intuitive understandings of the way the policy or planning body feels they ideally should go about their deliberations.

One of the useful applications for forecasting recipes is to develop the methodology for the recipe with the body that will have to act on its results. By developing the forecasting methodology based on the intuitive perception of the particular group, you have built in acceptance of the results. This will give you an impetus for action to avoid undesirable eventualities or to secure the kinds of results that have been forecast as possible by taking advantage of opportunities.

Contextual mapping can also be mentioned as a forecasting tool. While almost devoid of imposed structure, the datum in the form of hunches, expectations, extrapolation, and so forth, can be arranged and rearranged to develop insights about the potential points for effective intervention and possibly some mechanisms for producing desired change. Although contextual mapping since its development by Kennedy, et al. at RAND, has not been notably useful, this was probably due to overly rigorous expectations. Its chief value as I see it is to explore complex and ill-defined situations without imposing unwarranted structural biases.

EXPLICIT GROUP FORMATS

There will be some objections to including the kind of activities that I will refer to as using explicit group formats in a discussion of models. This is because explicit group formats are models for the policy making or planning body to use in its deliberations, rather than models of the activities to be planned for. Although there are many discussions of group dynamics techniques I am aware of very few applications that could serve as examples. Many insights have been gained from work on the psychology of small groups, but little has been applied to structuring the deliberations and other activities of planning and policy making bodies. Brainstorming is an example of a technique in this field that became fashionable, but was not assimilated. It possibly requires some status and fashion consciousness for a new technique to be introduced in this field, and indeed it may be a characteristic of explicit group formats that they always have to be "new."

Developing explicit group formats consists primarily of arranging sessions that will differ from the standard-open-plenary-sessions that are conducted under Roberts' Rules of Order -- beginning with old business, new business, with

motions and seconds and all the folderol. There is growing recognition, particularly among executive directors, that these types of sessions are not particularly productive, but the quest for improvement has been directed to trying to develop a better background paper and bringing a more imaginative proposal before the body, rather than changing the methodology of the deliberations of the body itself. Often the individual members of a planning board or policy making body could make important substantive contributions to the work of the agency. However, because of the format of the sessions they are often left with a role of little potency, and often the dynamics of the group situation favor the vocal and the dramatic, rather than the insightful.

There is no particular pattern for convening the ideal planning or policy meeting using a variety of explicit group formats, since one of the main points is to abolish the "standard" meeting. For example, one of the easiest things to do is to vary the location and environmental qualities of the meeting place. Because each place and setting will convey different implications, situational ethics, and trigger different responses. This alone may heighten the sensitivity of the group to each other and their environment.

I will enumerate several formats and suggest when they might be appropriate, but there are many other possibilities. For example, you can organize a policy making body into several sub-groups. Each one can then be assigned to constitute itself as the directing body of one of the important institutions or organizations in the environment for which they are making policy. You can then present each of the groups with several events or changes that have supposedly occurred that relate in a difficult way to policy issues they are considering. Ask them to formulate a response for the group they are stimulating. Then have

experts or representatives from these groups critique how well they acted in their roles. By conducting these exercises at the beginning of regular meetings for a period of time, one would be able to infuse a more general awareness of the effects of their policies and some of the dynamic relationships in the environment.

As another example, a planning body could be asked to role play for different individuals or interests in their planning environment. They would be asked to answer some questions, not as they would, but as they think the persons whose role they are playing might answer. Similar to the Newlywed Game on T.V., these questions and a series of possible answers should be prepared in advance. To validate what answer is considered best by each group being simulated, the question should be asked either to the individuals or interest groups that they are playing or to a panel of experts that is familiar with the opinions, attitudes, and values of those being portrayed. Each member of the planning body should be assigned to play several roles during the exercise. After several questions have been asked, then the answers given by the actual respondents will be revealed. You can then ask for an explanation of the discrepancies.

Many types of simple gaming exercises might serve as explicit group formats. However, in their construction these games will differ in complexity and rigor from those research games intended to simulate decision environments and their outcomes. In research oriented games the emphasis is to produce outcomes that are accurate reflections of the decision process. These games require elaborate rules and methodologies and include many details because the situation they are attempting to portray is complex. On the other hand, the interests of most policy and planning bodies are focused on how to intervene in the decision process. Therefore, simpler games that are constructed to highlight critical processes and issues will serve as well -- and the tolerance for pain of the individual members won't be taxed. We have termed this class of games participant exercises.

Other examples I will just mention are floor-time allotment schemes that reward positive statements by giving the speaker higher priority and longer time for additional contributions. Another scheme would be to set a time limit for formulating policy or planning proposals that will be tested by a panel of protagonist experts while the group considers the next matter, by which time they get a response from the experts on their previous proposal to deal with. By using a fast cycle of proposal-response many options that are discussed, but never tried, can be explored in terms of likely outcomes predicted by experts. Finally, you can ask sub-groups to develop specific planning programs for a 2 or 3 year period. Then during their deliberations introduce changes in the situation, perturbing events, changes in objectives, or bad publicity for undertakings that are somehow related;to test the program formulation process being used by each subgroup. Conducting critiques of the performance of the sub-groups after the exercise is an important part of the experience.

PROBABILITY SYNTHESIZERS

The class of intuitive models I call probability synthesizers is probably the most rigorous of the types of intuitive models we have discussed here. The development of this area I trace primarily to the work of Dr. Ward Edwards at the University of Michigan. Edwards' speeches and writings are well laced with examples of how poorly humans presently aggregate information sequentially. Human judgments have proved very reliable on things they have experienced, but in complex situations,where probabilities must be added,human processors are poor at integrating the outcomes of several individual events that can be estimated individually by intuition fairly accurately. The human processors do not add the probabilities very well and are limited in their capacity to keep track of many eventualities.

However, one can synthesize better estimates from the individual probabilities by using a computerized model, based on Bayes' theorem. Most of Edwards' applications have been in military planning, however, the application of these techniques to urban problems could be very fruitful. This is because probability synthesizers allow a variety of individual estimates to be put together into a single framework, without the messy group dynamics of bargaining among a variety of experts. Bargaining is generally helpful in refining programs among competing groups, but is not particularly helpful when trying to integrate the expertise of a variety of individuals who are supposed to be on the same team.

Bayes' Theorem, named after a British clergyman who supposedly convinced the mathematician LaPlace that he understood the theorem, even though he never explicitly stated it, provides a basis for aggregating individual observations. The theorem specifies how men should revise their subjective probabilities in the light of additional information. What makes the theorem and the work developed from it particularly useful is that the theorem can be applied equally to information of varying quality, and from different sources or lines of evidence. There are problems in processing items that are correlated rather than independent, but in many cases this does not affect the outcome. In the cases where it will materially affect results it can usually be taken into account -- by human judgment.

As Edwards wrote:

> Compared with the standard of Bayes theorem, men are conservative information processors, unable to extract from the data anything like as much certainty as the data justify. This is because they are unable to aggregate properly the data available, not because they misunderstood the meaning of any single datum. The value of this processing routine to building systems based on intuitive datum is obvious.

There are basically two types of probability synthesizers. One, Edwards calls probabilistic information processing systems. These systems are intended to perform diagnostic information processing, that is, to figure out what is going on in the milieu in question by putting together individually inconclusive items of evidence. This requires two tasks; one, the evaluation of the likely diagnostic impact of each separate datum on the hypotheses of interest, is necessarily performed by means of human judgments. This is especially true of the vague, verbal, qualitative data and hypotheses that in general are available to describe the urban environment. The second task, aggregating a large body of evidence to test and suggest hypotheses can be computerized by means of Bayes' Theorem. The potential applications for using this system to formulate and test policies, to monitoring the urban environment for crises using the suggested resident urban observers, and to look for development opportunities for both the public and private sector are numerous. To my knowledge, no such applications have been made, but I'd like to advertise as being interested in undertaking their development.

The second type of probability synthesizers were developed for resource allocation problems, where the information on which the system must rely is intuitive. Dick Kaplan of RAND (who replenished my file on this topic) along with Edwards and Miller, developed an application for allocating tactical aircraft for close air support -- a system called JUDGE. This system used explicit human numerical judgments of the values of destroying various targets, the probability of destroying the target, probabilities of attrition, an algorithm for turn around time, a factor for weather, and so forth, in a dispatching rule to allocate aircraft to missions from a limited supply against the requested targets. A field study, and laboratory simulation have compared JUDGE's dispatching decisions with direct human dispatching decisions.

Of course, in this situation any system, no matter how stupid, will earn some points -- since all systems will dispatch planes and destroy targets. A scale for measuring performance was devised by calling the amount of value earned by a first-come-first-served system 0 and the amount of value earned by an unattainable optimum system that knows the future exactly and so can dispatch planes with the equivalent of perfect hindsight 1.00. On that scale, human dispatching decisions typically earn about 0.50. JUDGE, however, consistently earned about 0.90. This difference is large and reliable. The potential of a system based on this model to provide assistance in Model Cities management is great. I'm sure many other areas suggest themselves as applications, particularly in valuing the benefits of public works and social services programs in the light of the subjective responses of potential recipients and experts' forecasts of changes in these responses in the future.

I recognize at the end of this presentation that the confusion with intuitive models must be at least as great as the confusion with purely mathematical models. It is not likely that the demarcations in this field of intuitive models will ever be as clear as in the field of mathematical models. However, I hope I have been able to indicate that intuitive models offer promise in producing greater movement and inducing open-endedness in policy making and planning bodies because the members of these bodies will be more conversant with the stuff out of which the models are made, that is, with intuitive insights. You have no doubt become bored, I'm confused, and the time is over. A typical prisoners' dilemma outcome (Rappaport) -- everybody lost.

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