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ABSTRACT

As one of a series of reports in progress, this report is introduced with a discussion of the concepts underlying long-range planning of any kind, and the methods of research used to describe alternative patterns of evolution or change within various policy fields. The FAR method, which emerged out of the Contingent U.S. Patterns (CUSPs) analysis project, is an example. This method involves the projection of particular quasi-organic whole-body futures and sets of such futures that promise to describe or bracket the actual, unknowable course of things to come. It requires an alternation of attention between wholes and parts, between artistic apperception or the knowledge of details, and the logical analysis of interaction among the parts of wholes as in scientific modes of inquiry. In this way a sober effort has been made to keep the method of projecting commensurate with the decision making process relying chiefly on individual gestalt appreciations. The successive cycles of analysis, component steps of projection, and the sectors and sector/factors of a matrix are described. The sectors are revised and mapped leading toward a "values tree" to be compared or merged with a "constraints/opportunities tree" to form a model of the aspects of United States society for generating alternative future histories. The current FAR method can be effectively used for the projection of a wider variety of future contexts from worldwide scope down to any locality that may be treated as a whole, such as education, social problems, the concerns of planning urban transportation systems, business planning, or social science research generally within a sociogeographical field. (Author/VW)

PROJECTING WHOLE-BODY FUTURE PATTERNS— THE FIELD ANOMALY RELAXATION (FAR) METHOD

Memorandum Report
EPRC 6747-10

Prepared for:

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Educational Policy Research Center

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Research Memorandum

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This is a report of work performed by members of Johnson Research Associates, under subcontract to the Educational Policy Research Center of Stanford Research Institute. It is a contribution to work in progress, and later studies may modify the findings. The authors are solely responsible for its contents.

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INTRODUCTION AND SUMMARY DISCUSSION

The executive who must plan, or actually take, a step now that will not reap its benefits nor have its weaknesses exposed through implementation for years to come needs future contexts within which to place such decisions. This report is a product of a particular decade-long program of contextual analysis founded on a belief in the importance of wholeness within operational settings. A plateau of understanding seems to have been gained about:

- Why a prudent, responsible executive might feel a need for holistic projections of the future.
- What such projections should be like.
- How projections with the needed attributes may be engendered.
- What new applications and extensions of the developed method promise to be fruitful.

Emphasis is placed on method. Inward-looking at research approaches does not explain the story, however. The body of work to be described has been and will be pragmatically founded, and the method to be displayed is an oporational, practical, work-a-day tool. Therefore, it is imperative that the description of technique be nested within a discussion of the potential worth of the product--of the niche within which whole-body projections of future patterns may be expected to fit in relation to decision-making and to other kinds of policy-oriented research. Results of past and current applications of the evolving method will be described only if they prove illustrative, and past methodological exploration will be raised only if needed to help show why one procedure is favored over another.

When the future arrives, it may differ wildly from the present in detail, but it will resemble the existing pattern in a few major respects. There will only be one of it--future--and each parameter of change will have a particular value; its parts will coexist within an intricate system of mediating "rules of engagement" which are themselves to be enumerated among its parts; and it will trail behind its own distinctive history. Its parts will fit together (however uneasily), and its changing patterns will show sequential consistency through time. Therefore, a "future" is visualized as being a present-sized tube running from the past through the present and twisting off along some unexperienced line of evolution. We think of such a tube as being a quasi-organic whole, remaining attentive both to the powers and risks when analysis leans on analogies with other wholes in which the quality of organization is different in kind and degree.

The projection of particular whole-body futures and sets of such futures that promise to bracket the actual, unknowable course of things to come requires an alternation of attention between wholes and parts--between artistic apperception (informed by knowledge of details), and logical analysis of interactions among the parts of which wholes are composed (informed by appreciation of those wholes). This process has acquired a form similar to the powerful relaxation methods of mathematical engineering, and the method has been nicknamed Field Anomaly Relaxation--FAR.

Long range planners design courses of action that will impact on and find meaning in conditions that will not become clear for many years, and the policy maker converts the plans from abstract possibilities into designated steps to be implemented. The mental acts of individuals when engaged in such tasks must be performed with some impression, even if entirely implicit, of the future operational environment in question.

In opposition to this inescapable need, we find the equally unyielding fact that no one can reliably predict the future. The entire research effort culminating in the methods to be discussed may be viewed as a detour around this dilemma--a fall-back to ways of generating useful future contexts that are (as prophesy is not) within the reach of the research arts. The word "art" is important, since it appears that the means of policy formulation are fundamentally artistic, with logic being used as a powerful but secondary aid to insight. The character of the planner's dilemma and of the ways of eluding it are influenced deeply by this, and a sober effort has been made to keep the method of projecting whole-body futures commensurate with the decision-making process through a careful interweaving of logic and art. These considerations have dictated two methodological conclusions.

First, any single-value projection of the future is inadequate for responsible policy planning. In fact, the best that can be said after careful study of the more predictable elements of the future is that one of a relatively small set of holistic futures could result or, more exactly, that a future "probability space" bounded by such a set probably will contain the actual future, which in that case would partake of but not be identical with any one of the delineated bounding alternatives. Plans that could accommodate to each of those bounding alternatives, however, should be expected to be flexible enough to deal with the actuality when it makes itself known.

Second, the richness of the subject matter, and the complete absence of strict methods suitable for dealing with it exactly, requires that work of the kind treated in this report be qualitative in character. This limitation must be accepted, not just temporarily, but into the foreseeable future.

While it is correct to say that the present (and therefore the future) is a whole, it also is true that one can and does subdivide that whole in many ways. There are different-size regions and different topics for attention within each such region, and each such place or topic would be subject, in general, to holistic projections of the kind considered in this paper.

Johnson Research Associates (JRA) projections of world-wide planning contexts, made during the 1960s, lay out a bracketing set of alternative lines of politico-economic development for the planet during the next few decades. The Projected World Patterns (PWPs)* already have been used as bases both for analysis into and decisions concerned with several different policy questions in the fields of military and industrial planning. Alternative whole-body futures may be projected for a major nation or world region for each of the PWPs that are judged to be sufficiently relevant.

The Contingent U.S. Patterns (CUSPs)† now under development offer an example of such regional projections as would corresponding pro-projections for other places--the USSR, Western Europe, East Asia, and so forth. Within each contingent projection, there exists the opportunity to explore alternative patterns of evolution within various policy fields, e.g., population, economic development, any particular business, or education (which is the focus in the CUSP analysis to date). A next-echelon evidently exists as well, and others below it, as one might attend, for

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* Projected World Patterns, Douglas Aircraft Company and Johnson Research Associates, Vol. I and II, 1966.

† The initial report of this effort was entitled "Contingent U.S. Patterns, 1970-2000, An Exemplary Application of FARM," by R. F. Rhyne (Johnson Research Associates Report RM 69-3; December 1969). This on going work by an SRI/JRA team is being performed by the SRI Educational Policy Research Center in support of policy formulation by the U.S. Office of Education.

instance, to individual states or parts of them within the USA or to even smaller regions such as the San Francisco Bay Area.

The cascading of regional contexts and the policy issues within them have important implications, to be treated in the body of this report. There are two different kinds of projections to which the FAR method is directly applicable: (1) the full patterns of life within a given region, and (2) the patterns of relationship within various policy fields or institutions significant over all or much of the geographic area in question.

The report is organized as follows. After a brief discussion of roots, a major section is devoted to the character of policy formulation, when it is argued that the processes involve primarily gestalt appreciations and that holistic projections therefore are especially needed. The body of the report describes a method for making such projections and a terminal section suggests some new applications and extensions of that method. Certain concepts underlie the whole treatment, however, and consequently should be summarized here.

ROOTS

Much of this paper will be concerned with associations among variables and processes, but a method of dealing with complex patterns also must have its own phylogenetic roots; some nuances of its developed form are dependent on how it arrived at where it is. The approaches to be elaborated have grown a step at a time toward general utility as practical policy-analysis challenges were met, one after another.

The principals in Johnson Research Associates were drawn together during the 1960s by a common belief in the primary importance of context in many of the more realistic problems faced by operations and systems analyses. It was understood from the start that the core efforts would have to be qualitative. Far from being a retreat to safe, vague, and irrelevant issues, this movement toward the analysis of qualitative relations between plans and their surroundings was dictated by the sobering discovery that day-by-day planning and executive decision needed just such help and that in many urgently practical problems, purely quantitative analysis could at best serve heuristic purposes and might teach incompatible truths and thereby become diversionary and confusing.

The explicit focus on alternative, whole-body projections was induced by the discovery that the corporate ten year plan of one client was being founded on component plans (submitted by the several divisions of the company) that were embedded in different, mutually exclusive pictures of what the world might be like during the ten year period in question. That is, a meld of conditions that would tend to determine market potentials, labor costs, technological growth rates, floor-space requirements, and so forth, had been visualized by each division planner, but the patterns were such that at most of one of them could have occurred.

This led to the almost evident suggestion that each planner might be asked to evaluate his component plan several times, assuming sequentially that each of the other divisions' "worlds," as well as the one that he had hypothesized were to come to pass. When the implicit parts of each assumed planning context were examined, it proved that even the proponents of each alternative world felt that there were adjustments to be made. JRA found, somewhat uneasily, that it was in the business of helping to generate (and then improving the internal consistency of) a set of alternative projections of worldwide planning contexts. During the period 1963-68, the currently available set of Projected World Patterns (PWPs) were developed and refined through application to the planning needs of a number of different clients, all under subcontract to the Douglas Aircraft Company.

The methods of research that evolved during the production of the PWPs and the actual projections formed the points of departure for a current, continuing effort to project, apply, and progressively refine a set of descriptions of alternative lines of evolution within the United States, Contingent U.S. Patterns (CUSPs). That effort is a part of the broader program of the Educational Policy Research Center (EPRC) at Stanford Research Institute, with JRA aiding the staff of the EPRC in a subcontractual mode. The CUSP results to date and the extensions of the original method will form the chief source of illustrative examples in this paper. The lessons learned during the course of the work to date are subsumed, however, and the method presented in this report is that which we now believe should have been applied during the past year's research, and it is not always the one that actually was used.

RESEARCH IN SUPPORT OF DECISION

The Appropriate Relation Between Research and Policy Decision

It is argued that the character of policy formulation now and in future decades is such that rational modes of decision-making will have to give way to suprarational and essentially artistic insights by individuals. Therefore, the role of research should be viewed as tutorial in nature, devoted to the supporting role of enhancing the implicit understanding of those who, one at a time and acting as individuals, must make the decisions demanded of them. Research should offer aids to comprehension, not answers, and the projection of operational contexts becomes especially important.

It was written by Gibran in The Prophet that "God rests in reason," and "God moves in passion." The same may be said of man.

Decision may mark the end of resting and the beginning of motion, but it is more of the latter. Only rarely can it be a purely rational step, being instead a whole-body response to a complex meld of risk, opportunity, actions to be weighed, values to be hostaged or bought, and many apparently secondary matters that may or may not be significant. Even for relatively simple problems, such as choosing a wife or winning her or deciding on a change of profession, the man who nominates purely rational methods is recognized as a comic figure. When decisions concerning the destinies and happiness of larger numbers of people--where the stuff of the problem is much the same but where the working information is far less complete--a similar use of calculation or the rigorous application of logic is more likely to be tragic. Final reliance must

be on the only available tool as broad as the problem--gestalt-type judgement born of a "feeling" for the problem-within-the-situation.

Logic and clear lines of calculation from established scientific generalities are valuable, helping as no other intellectual tools have been able to in answering questions of "how" and in drawing illustrative conclusions as to the consequences of specified actions within stylized but nevertheless instructive situations. Policy formulation, however, must treat as much with questions of "whether" and "for what purpose" as with those of "how." That is, policy decisions must be as attentive to benefit and value as to feasibility because logic is too narrow. It is fair to described rigorous argument as a syllogism-by-syllogism, inch-worm's path across a picture. That is an excellent way to explore a particular line (or, more broadly, some isolated chain of causes), but it fails when the objective is that of appreciating the character of a whole.

In contrast, the half-mental, half-visceral process of holistic inner synthesis is as broad as the problem, and therefore it almost always is relied on in preference to mere reason in policymaking decisions. True, a modern decision-maker uses both scientific inputs and intuition, but he usually gives priority to the latter, with reason and science employed to refine and extend the body of inner comprehension from which the answer finally is to come. So employed, the gestalt decision process is a suprarational rather than a subrational one, engaging more (not less) than the intellect. It permits concurrent consideration of more factors and associations than can be dealt with analytically and allows for the inclusion within one process of rational conclusions and obscure feelings--of some elements that do and others that do not stand on well constructed ladders of scientific generalization and test.

While the arguments advanced in this paper apply to research in support of most kinds of policy decisions, they are especially pointed at the more complex issues that arise when inclusive problems are to be considered. Every increase in scope imposes geometrically increasing complexities, however, and the judicious policymaker therefore cuts his field as narrowly as possible. Then, why assume that few major problems may safely be approached in isolation? The answer lies in what seems to be a salient characteristic of this era, a condition that may have ruled to some extent in the past in various isolated parts of the world but that never before in history has presented the whole human race with so many interlinked chances to fail as earth's dominant species.

A number of diverse currents are beginning to crest, merging with and modifying each other in ways that all too often threaten not only the expansion but even the continued existence of order within freedom for humanity. Not one of them is new, and all of the interactions to be considered have been occurring to some extent for decades. It is the intensity of the separate associations, their coincidence in time, and the way in which the adverse ones seem to be mutually exacerbating that make the future decades appear so menacing and which bring to mind with special force the old Chinese curse, "May you live in interesting time."

Kaleidoscopic technical change; instant (but fragmentary) communications from all parts of the free world; the crisis in values and the closely associated hiatus in the intergenerational transmission of cultural norms; population pressures; racial antagonisms; and newly emergent scientific powers over the genetic "heritage" of mankind are changes that are mixing together now and seem likely to do so more forcefully in coming years. Under different possible overall conditions, it may be possible to think of one or another of the separate elements as being relatively independent of the others. In general, however, the distinctive factor

about this interwoven mass of problems is that its parts are concurrently variant, to be analyzed or dealt with all at the same time. In a real sense, therefore, the merged set of concerns should be thought of as a single, transcendent problem; it has been appropriately labeled the "macroproblem" by various spokesmen.*

To conclude that policy determination within one sector of the macroproblem requires attention to the rest of it is not the same, fortunately, as saying that the whole problem must be solved before any part of it can be. Acceptance of the idea that the whole must to some extent be comprehended when making decisions relating to its parts, however, does make it extremely improbable that closed, logically explicit methods of decision or of decision analysis often will prove to be sufficient. The problem is one of using research to enhance the only powers that have proven commensurate with problems of such scope, the gestalt appreciations of wise individuals.

Reason in general, and research in particular, should be recognized as existing in a supporting relation to policy formulation, somewhat as the handlers of a prize fighter relate to their man. In each case, the task is in trying to prepare the one on whom the privilege and burden of action will fall so that his performance at the crucial moment will approach his maximum potential. The "moment of truth" is no joke, and it is always lonely. Policy research, seen in this light, should be designed and conducted to enhance the inner comprehension from which decision must be compounded; it never should be substituted for holistic insight in the determination of policy.

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* Peccei, A., The Chasm Ahead, MacMillan Co., London, 1969, and Harman, W., Alternative Futures and Educational Policy, Stanford Research Institute Memorandum Report EPRC 6747-6, 1970.

Within the essentially tutorial, supporting service suggested, however, there is room for wisdom, ingenuity, success, and failure. Many kinds of research techniques have been developed, and most of them may serve policymakers almost indispensibly in at least some times and ways; at the same time it is true that there are few methods that may not be misused to confuse or distort the gestalt comprehension that is the real objective. The powers of research may be applied safely only if the limitations of each method are considered attentively.

Kinds of Research in Support of Policy Formulation

Four general research approaches are applied in support of policy formulation. One of these, the exploration and testing of specific hypotheses pertaining to particular causal relations, is well known and will absorb most of the resources to be assigned to policy-support research. A second approach is that of operations, systems, or decision analysis--fields whose definitions remain unclear even to the analyst and which overlap at many points. The third offers forecasts of events and trends; and the fourth approach, characterized by minimum specificity and maximum scope, is that of whole-body projection. The first three will be discussed briefly, not because they are unimportant but because they are relatively well known. Primary attention will be paid to the fourth.

As an example of the first, the progressive extension of the scope and reliability of scientific generalizations pertinent to population policies is essential if policymakers in the field are to estimate, with increasing reliability, the direct consequences of their decisions. It deals with relationships among topics such as direct fertility control, social and economic conditions, human breeding habits, human migration, geriatrics, genetic manipulation and so forth. For some cases, the rules of cause and effect may be phrased with attention only defined to aspects

of the environment. Given a set of measurable external conditions--temperature, atmospheric composition and so forth--a specified cause may lead reliably to its predicted effect. In others, however, a comprehensive understanding of the sociophysical environment is needed before it can be predicted whether the statement "A caused B" can be transposed from the conditions in which it was observed to some other setting. Contextual studies may aid (and be aided by) specific inquiries into the categories of environmental conditions to be specified in relation to each putative causal law so that operational similarity among situations may be assured. There is little doubt that such inquiries can aid in making separate bits of scientific knowledge more useful to gestalt formations by decision-makers.

The different kinds of analyses within the second research approach are similar in that they seek to isolate a component field or system and within it to trace explicitly the interacting issues of cause and effect that influence effectiveness, costs, and (in some instances and always with important qualitative steps) the benefits to be realized if the system functions effectively. Scientific studies of component relations provide many of the elements from which these more inclusive, process-oriented analyses proceed, and the importance of contextual inquiries is increased. The latter is especially the case whenever the inquiry is extended to include benefit, since that entails estimation of values to be gained or lost--values that rarely make sense except within a fully elaborated context.

Research is aiding policy formulation in a third distinctive way, through the forecasting of particular events, usually through extrapolation of existing quantitative trends. Such extrapolations are most often

made and believed for the near future, within the first of Platt's* three future periods in which most changes are fixed by past and present inertias. Unfortunately, it never is clear just how many years that period may last for any given field of extrapolation, so specification of assumptions as to embracing conditions is important, but on the whole this type of policy research is valued highly. Another approach, quite different in character, is that represented by the Delphi† approach, in which the raw material of forecasting is a mass of collected statements of expectation regarding the probable dates of occurrence of specified events or discoveries. Many conditions may be visualized, of course, in which expectation can have no more sound base than implicit belief, and facts as to the structure of such belief within relevant populations are among the materials that may aid a potential decision-maker to comprehend his problem within a situation. Even if he doubts that the event in question will happen, a popular belief that it will do so is itself a factor to be considered.

The Niche of Projected Whole-Body Futures

Some sense of future prospects almost has to be used by any long range planner, even if he does no more than implicitly assume that the future will be so much like the present that changes do not need to be considered. It is realized generally that a plan's feasibility and worth should be assessed in relation to the conditions within which it may be expected to come to fruition. This still would be true if the logical

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* "How Men Can Shape Their Future" (unpublished), John Platt, University of Michigan.

† "Forecasts of Some Technological and Scientific Developments and Their Social Consequences," T. J. Gordon and R. H. Ament, Institute for the Future, IFF Report R-6, September 1969.

count-down of the systems analyst (from objectives through means to preferred courses of action) reflected the actual decision process. Since that process usually is, instead, the kind described earlier, the kind of context needed must match. To serve as the seed bed for executive insight (rather than just to provide specific inputs to an analyst's equations), the sense of the future conveyed by a future contextual description should approach as near as possible to the scope and quality of his existing sense of the present. At a minimum, it should resemble the present in two key respects: it should be such that its many parts are mutually consistent (even if, as in the present, uneasily so), and it should trail behind it its own distinctive history.

This poses a dilemma; the need for a rich description of future contexts is ineluctible, and so is the fact that reliable prediction is (and promises to remain) entirely beyond the state of the analytic arts. Furthermore, even if one were to consider a less demanding definition of prediction, and accept the nomination of the most probable single future alternative among the many that are conceivable, that still would help only a little. The variables bearing on victory in a horse race are relatively few and determinable, as compared with those needed to predict a fully elaborated future condition, and even so the odds on the favorite are rarely as high as one to one (which would be the same, disregarding the "take" of the track, as a 50 percent chance that the favorite would win). Suppose, then, that the "favorite" future alternative could be assigned the remarkably high probability of 25 percent of transpiring; planning just in terms of it would leave an executive wrong 75 percent of the time, on the average. Prediction, then, is out.

The planner can escape the dilemma by disregarding all or part of it by: (1) assuming a changeless world, except in some few selected areas of attention as often is done in technical forecasting; (2) assuming that

the course of the future is obvious and that those who must think and act in concert to make a given plan work out all have a common picture of what that "obvious" future is; or (3) gaining an intellectual picture through study of many extrapolation fans (with a curve showing the mean and some variation around it) which may tell the story about one item at a time, but that obscures as much as it illuminates any particular picture, of the sort directly conducive to artistic powers of inner synthesis. Or, he can elude the dilemma in another way, personally if he has the time or through research or staff assistance if he does not, by relying on "What if---?" projections of holistic alternatives. This approach, resulting in whole-body projections can develop descriptions of the needed richness; practice with the methods indicates that they can be generated in acceptable form. However, this approach only makes sense if a set of illustrative cases is developed and used.

When serious efforts are made to search out distinctive lines of evolution that are characterized at each date in the future by internal consistency among their parts and by sequential continuity* from the past through the present and from date to date in the future, it is found that contenders are to be numbered only in dozens, instead of the thousands that might be expected. At the same time, there may be quite a few contenders that are too plausible looking to be casually discarded by a prudent planner. The problem becomes one of selecting a limited set (probably fewer than ten) and deciding how much insurance to employ--in the form of multiple evaluation of plans, within each of the designated contexts.

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* Not even revolutions are discontinuous, except in a few and ordinarily superficial dimensions of existence.

When such a set is developed, it forms the kind of a "tree" shown in Figure 1, where each individual whole-body projection is represented by a present-size tube taking its own individual route away from the

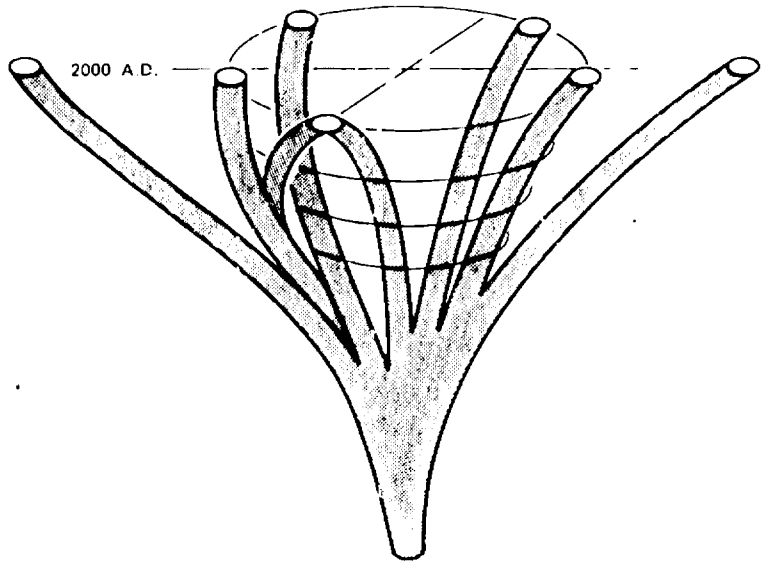


FIGURE 1 EIGHT FUTURES AND A PLANNING CONE

present. Some of the scenarios describing such projections will require a sequence of such apparently unlikely events that the cumulative time series would seem too implausible to merit serious attention; such cases lie outside the "planning cone" delineated by those traces that are judged to be just marginally plausible, while others would be found entirely within that cone. By definition, all traces lying in or along the boundaries of the planning cone would be recommended as worthy of executive consideration.

The question is not one of feasibility--such projections have been made; the methods of doing so are to be elaborated below, and the issue of credibility can only be resolved by the executive who might use them, applying the same kinds of gestalt insight that other decisions require. The problem is to show that such projections would be valuable if they were at hand, and it seems indeed that they would be. If the real process of decision is one featuring gestalt insight, then a comparably rich picture of illustrative situations within which a decision might work itself out seems indispensible. The executive would have to invent one if none were offered him, and while he might do that well, he rarely has the time to do it carefully enough and almost never has the time needed to record his assumptions. Whole-body projections, organized as above into a relevant set, seem to fill an urgent need that currently cannot be met otherwise. In particular, they would contribute uniquely to the primary task of helping to extend the seed bed of insight of the prospective policy-maker from the present, easily perceived field of events to hypothetical future fields in which such insight is needed. They offer a sort of pseudo, future experience to complement actual experience in the present and recent past and vicarious ones drawn from attention to history.

Such a set of whole-body projections also would offer a significant, secondary potential. If it were decided to use them so, they could serve as the basis for a sort of filing system for input materials from within an executive's own "stable" of staff and contract researchers. Bits of data drawn from different wholes may be true enough, as bits, and still be actively harmful if given heterogeneously to a person who is trying to form a rich comprehension of some particular problem within a situation. If, for example, the blind men of the fable had compared notes, they finally would have drawn an elephant based on their separate observations. But, suppose that each had fondled part of a different kind of animal while thinking that all were in contact with a single beast. If, in such

a case, they were to reach any synthesis at all, the result surely would come out monstrous. The executive seeking to build his gestalt comprehension of an organic whole who gets inputs from several different contexts is in a fairly good position; unless he knows precisely which bits come from which contexts, he may create a monster.

Suppose, however, that the executive authority over some business or governmental agency (large enough so that component plans are prepared, and concerned with long term issues) were to have developed for him a planning cone embracing three whole-body projections. Suppose, further, that he were to demand that those who produce component plans, and those others who are engaged in systems analyses and scientific investigations of various kinds, each assess the relevance and validity of their inputs to him within each of the three selected future contexts offered by the projections. It generally is true that variant projections will appear desirable in the eyes of staffers and researchers attending to particular parts of the whole area of concern of the institution in question, and such persons should be encouraged to evaluate their materials in other contexts as well as in the designated, common set, provided that they would expose that context to the inspection and review of others.

If such a system of evaluation within each of a common set of whole-body planning contexts were to be instituted, several advantages would seem likely to accrue, in addition to the primary objective of helping the policymaker to extend the springs of insight that are effectively prerequisite to executive decision.

- Each stage of planning and staff assessment would be more carefully and insightfully performed, as those involved were led (by the process of considering the ways in which different futures might affect their results) to gain more sophisticated personal views of the future.

- Each actual decision-maker would be protected somewhat against the normal impulse to think of the rules of commonsense as being the same for the future as for the present or the equally easy error of supposing that the changes from the present into the future are obvious to all.

- Central policy-makers who must depend on and work with component plans and fragments of policies submitted to them by parallel or subordinate staff elements could assure themselves that such components all would be born of the same known contexts, a condition without which there is little reason to expect that such pieces would prove to be integrable.

- Stylized scientific and analytic efforts ordinarily are abstracted from some particular kind of setting, even though it often is never described, but if the relevancy of experiments and analytic models to specified settings is assessed at the outset, they should better serve their primary function of helping to induce a rich understanding of one particular field after another. Without such explicit reference to known settings, they may be actively harmful by subjecting the unwarned decision-maker to dissociated bits of information that might be true in some conditions but not in the same condition.

Several disadvantages to such a use of alternative futures come to mind, but review of them suggests that they are not as notable as the advantages to be visualized.

- This would multiply the burdens of planning about three, assuming that about three alternative futures would be suggested. This assertion is not true. The preparation of a plan requires more effort usually than its assessment, so if the same quality of assessment were pursued in each future as had previously been sought in some single one, the total effort would be less than proportional to the number of futures considered. Furthermore, why assume that there would be any increase at all? Assessment is bounded practically by staff effort available, the job never being completed finally and within any given ceiling of effort, it would be more reasonable to spread that effort over a selected set of alternatives than to give intensive attention to some single alternative in the foreknowledge that it would be rather unlikely to eventuate.

- It would increase the burden on the executive at the head of the planning pyramid. Perhaps so if he let it do so, but he would have the authority to mitigate the burden somewhat, and the procedure suggested here would let him exercise the judgement expected of him and recover from the experts some key functions that he never should have surrendered. Actually, it should reduce the burden carried by the conscientious executive planner, since such a man is forced by other approaches into "off the cuff" hedges that inwardly he knows to be inadequately based. This mode of operation would let him live within one future alternative, checking the opinions of his subordinates concerning that particular situation against his own gestalt appreciation and assessing the significance of particular scientific and analytic inputs judged by their producers to be relevant there. Then after ingesting and responding within (an appropriately mixed metaphor) that one, he could turn to another.

- It would reduce the power of subordinate staff members to control events and plans by preemptive action--foreclosing alternatives by elaborating only one particular case. This objection is a sound one. Would it not be nice, however, if such power were indeed curtailed, with each subordinate specialist asked to show how his input to the whole would vary if one or another of a set of comparably plausible future conditions were to emerge?

A METHOD FOR THE PROJECTION OF COHERENT SETS OF WHOLE-BODY FUTURE PATTERNS--A KIND OF FIELD ANOMALY RELAXATION (FAR)

General Considerations

The method that has emerged from the CUSP analysis requires a balanced alternation between appreciation of quasi-organic wholes and analysis of their parts--an almost even allocation of attention to artistic and scientific modes of inquiry. It is founded on the thesis that the laws governing relationships among the parts of a social field (e.g., a "tree" of alternative, whole-body futures) usually are dependent on the character of the whole composed of the parts. In terms familiar to mathematical physics, the equations of state within such a field, and even the selection of relevant variables within it, depend critically on the character of the whole, including its boundary conditions.

Such definite sounding terms would be misleading if used for more than a brief example, however. Far from there being any equations of state available for this work, it seems fair to say that the social sciences are not ready to establish rules to cover the detailed interaction within any natural (as contrasted with stylized) setting; they are even less able to offer such rules in general form to apply to all settings that might appear plausible within a given region and time frame. The approach described here, therefore, relies chiefly on individual gestalt appreciations (compared, discussed, reviewed within the research group and outside it, but nevertheless essentially personal) to tell when a given association between two parts or among a number of them "fits" within the whole as it is comprehended at that stage of inquiry. This is not regarded as a weakness; rather, it is seen as

a rejection of an excessive scientism in policy-oriented research that is suspect in general and actively pernicious in future projection. The mode chosen creates a structural parallel between the research and the decisions that it is intended to serve.

These ideas have been put together in a pragmatic, work-a-day form of analysis analgous to the relaxation methods of mathematical engineering, following a cyclic pattern in which anomalies exposed during one examination of the problem are sequentially corrected--"relaxed"--during successive cycles. In general, such approaches seem applicable to almost any problem in which equilibrium is at issue. The key problem is that of planning a sequence of research steps so that the end of one cycle through the problem leads into the start of the next one. The sequenced research tasks should be heuristic so that comprehension may be expected to grow within each full cycle; it is obligatory (within any adaptation of the FAR method as visualized at this time) that the same general steps of analysis be followed on each successive cycle, so that differences between results from successive cycles of analysis may be sensed readily. Such comparisons offer one of the main opportunities for uncovering the anomalies that are to be successively relaxed, and the adequacy of the solution after any cycle is to be measured in terms of the number of significance of such anomalies.

The particular format of steps within each cycle that has proved so effective in the CUSP work promises to be applicable directly to many analagous problems and to be adaptable to others. The cycle and its four steps will be discussed in detail, with a minimum of digression or exemplification. The compressed description will be leavened by a discussion of lessons learned during the first year's work on the CUSP problem, illustrating the experiential reasons behind what otherwise might seem arbitrary prescriptions. The potential for parallel kinds of

application will be discussed, together with the ways in which such application promises a growing, accretive body of comprehension of the alternatives facing humanity within geographic extents ranging from the whole world down to the purely local. Finally, there will be a relatively brief discussion of ways in which different FAR formats might be used to give corresponding entre to problems touched on but not solved during the world to date.

The Basic FAR Cycle

The FAR cycle employed now and proposed for use in projections of alternative future patterns for any reasonably homogeneous region is illustrated in Figure 2. The equal division between wholes and parts reflects the conviction that the two should be considered equally significant, although the actual assignment of effort within a given cycle might not be.

The analysis should be started (Step 1) in the "wholes" regime with a "first cut" at the answer--a visualization and brief recording of initial ideas as to the structure and general content of the entire

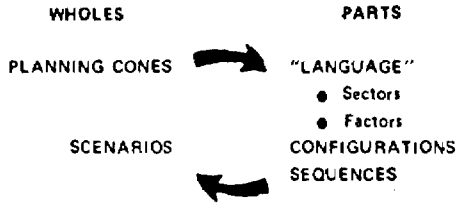


FIGURE 2 THE FAR CYCLE

set of plausible future alternatives that a prudent planner should consider. Such an embracing gestalt of the entire field to be studied, fallible though it may be expected to be at the start, provides the best basis available for the designation (Step 2) of component elements to be inquired into in more detail and through the use of more analytical approaches. Such constructs then are manipulated (Step 3) to generate an extensive roster of the schematized whole conditions that might merit attention and to filter from that morphological array the high proportion of such configurations that prove to be inconsistent internally. The residue of apparently self-consistent configurations are strung together to form exemplary outlines of scenarios. Finally, insights gained from the two prior steps and the exemplary scenario outlines developed are used as bases for construction of detailed whole-body projections of alternative lines of future development for the region under consideration and over the selected time frame (Step 4).

Such enriched scenarios form the basis for a re-do of the futures "tree" of Step 1, which begins the next cycle. When the process settles and successive cycles show no significant differences at any one of the four steps, the task is completed. When the differences exposed no longer seem likely to cause different decisions within the policy field in question, they are insignificant, "by definition."

Component Steps: The Current "Cook Book" for FAR Future Projection

Step 1: Organization of Separate Projections Into a Linked Set

This step is the one least subject to orderly description, since its essence lies in comprehending viscerally a large and diversified mass of information. Inputs consist of the analysts' whole knowledge of existing scenarios from all sources, apparently relevant historical incidents, and whatever may be available in the way of planning cones and futures trees

from earlier cycles of analysis. Also needed is a concept of alternative external contexts; regional projections such as CUSPs must, for example, be embedded in alternative worldwide patterns. Over and above such working resources are the analyst's talent for composition and the quality of the organizing structure of belief and expectation through which he filters (and into which he fits) the bits of data that flood from all sides.

The methods by which such diverse materials are composed are mysterious and may be expected to remain so for a long time. Indeed, it somewhat prejudices the effort to understand them when they are called "methods," since that implies a sequenced, practiced drill. That approach is rarely tried seriously and almost never seems to work well. There are, however, a number of tricks that we can play to make the magician who is within each of us ply his golden trade a bit less indolently. One big hurdle to surmount is that of making ourselves go beyond mere scanning of input materials to a gut-felt engagement with them. A very valuable way of doing this is to try to defend and teach our scenarios and their association to others.

Also, this is one type of work in which group research can be a reality, and unreserved discussion among well informed people is useful, working especially well when the members of the circle have differing viewpoints. As still another device for stirring engagement and holistic comprehension, gaming seems attractive, especially in view of its great success within military staffs and other groups in achieving goals, but there has not been time in the CUSP work to design and try such a game.

Also, the simple practice of drawing and redrawing the futures "tree," spread in terms of different variables and detailed in accord with comparative analysis through group discussion, is a powerful aid to comprehension. Figures 3 and 4 show two views of the "tree," one using a qualitative idea of Faustianness to achieve a geometric spread--with a

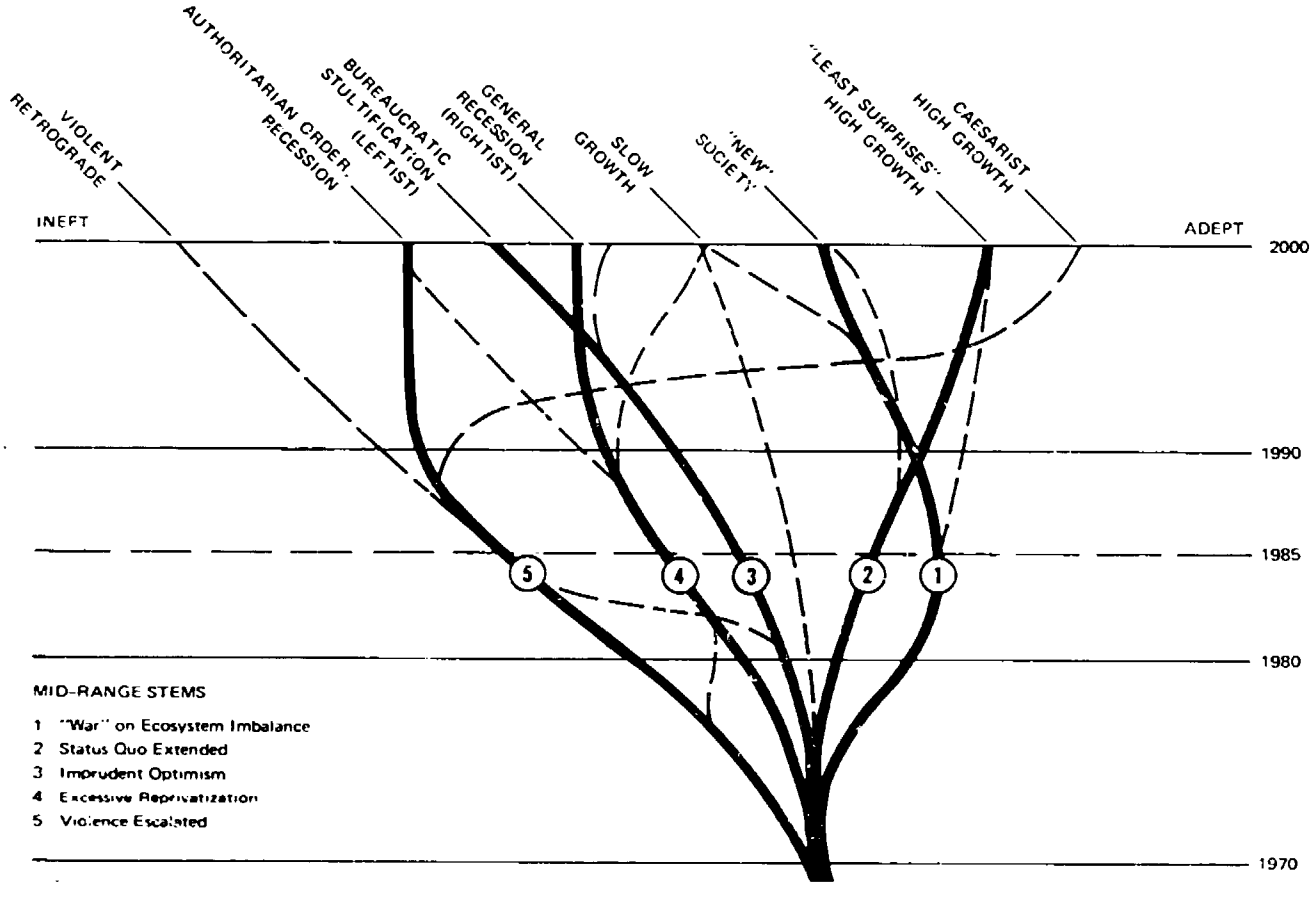
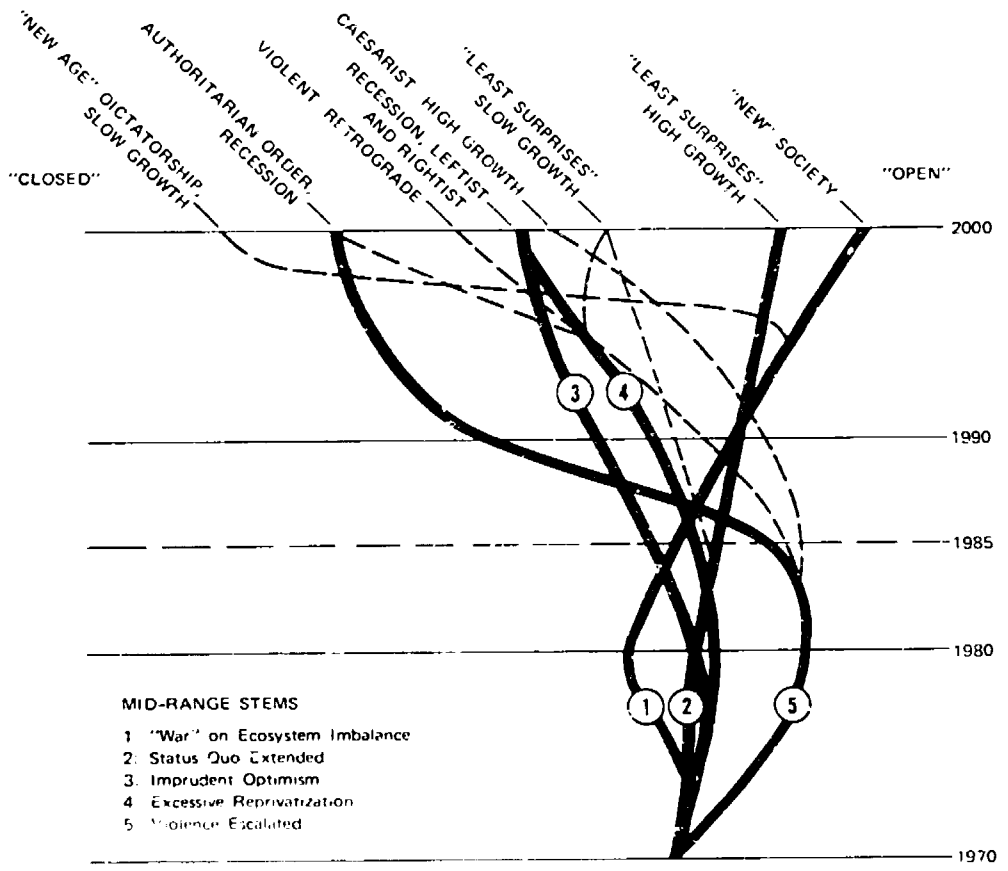


FIGURE 3 FUTURES TREE USING QUALITATIVE IDEA OF FAUSTIANNESS TO ACHIEVE A GEOMETRIC SPREAD



...AD IN TERMS OF SOCIAL OPE...

scale running from an extreme of "Can and Will" at the right to "Can't or Won't" at the left--and the other spread in terms of social openness. A transverse cut through the same variable space is shown in Figure 5, where an imaginary plane is passed through both the other two figures at 2000 A.D., and the intercepts of the various branches are located accordingly.

In essence, Step 1 requires providing a few insightful individuals who are familiar with the method with appropriate materials and time to work, while inducing them to pursue a wise synthesis rather than to go into diversification. The goal is the enhancement of comprehension of the kind illustrated by the drawings of future field shown in Figure 3, 4, and 5 and the production of materials and briefings to help others toward the same comprehension.

Step 2: The Selection and Description of Constructs

The gestalt awareness gained in Step 1 is difficult to retain clearly within one's own mind, difficult to explain to others, and difficult to adjust in response to criticism unless it is given some structure, and the FAR method requires the development of a schematic language to service such functions. What is needed is a manipulable set of categories such that all plausible conditions within each of a small number of key societal dimensions or aspects may be designated; with such a scheme, we may take any plausible overall condition for the region and within the time frame under consideration and place it in relation to any other such condition in terms of the chosen constructs. The main societal dimensions to be selected have been named "Sectors" and the alternative conditions within each sector are called "Factors," in the work done to date. The following list indicates the sectors and their factors that were used in

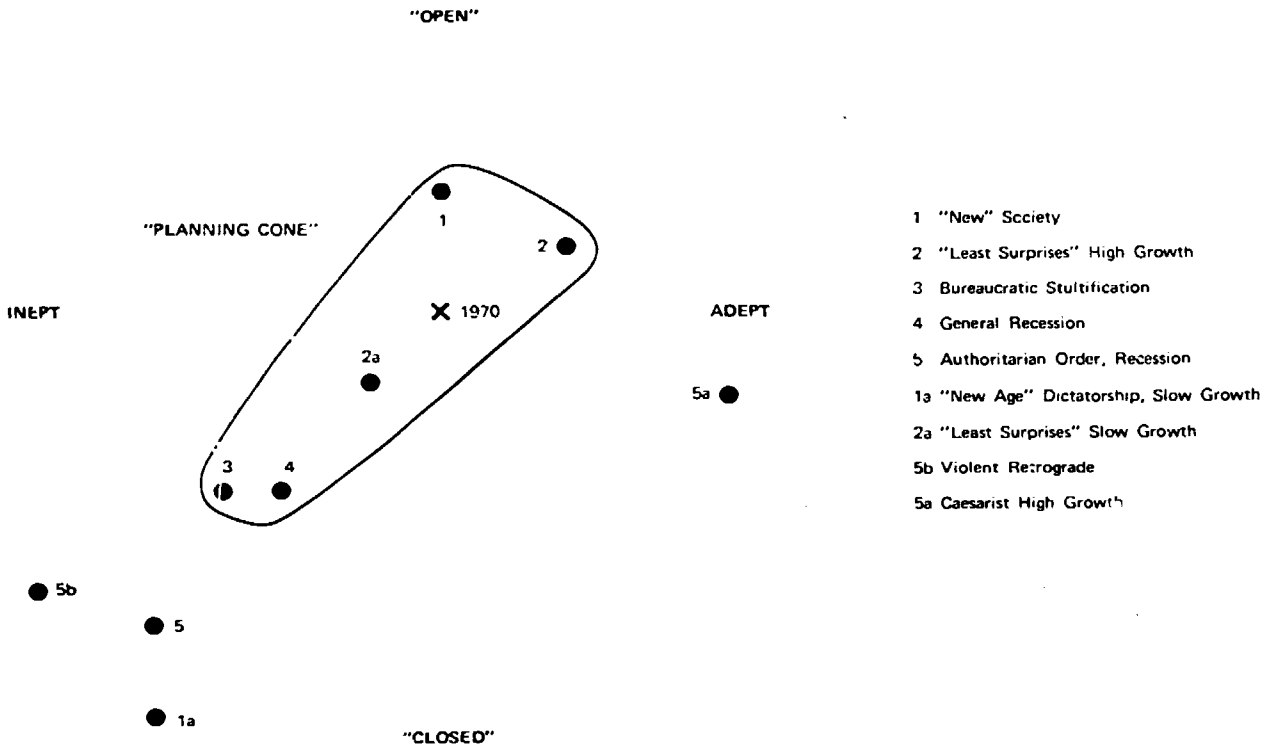


FIGURE 5 A TRANSVERSE CUT THROUGH THE VARIABLE SPACE ILLUSTRATED IN FIGURES 3 AND 4

FACTOR ROSTER: "EXTERNAL" SECTORS
(1969)

U.S. Economies

E_1: Prosperous, expanding-free enterprise

E_2: Slow growth, stagnant-free enterprise

E_3: Depression--start under free enterprise

E_4: Prosperous, expanding--strong government control

E_5: Unsuccessful government control

E_6: A nonexpanding, successful economy

E_7: Communalism

U.S. Internal Politics

I_1: Status quo

I_2: Increased [illegible] power

I_3: Shift of [illegible] locus to state/local

I_4: Single-party government

I_5: Direct democracy, multiparty

I_6: Cybernetic bureaucracy

[illegible] and Technology

S_1: Rapidly expanding technology

S_2: Stasis; elite security

S_3: Stasis, little advance, much application

S_4: Active science; shift to behavioral science

S_5: Active science/technology; antipollution focus

U.S. Demographic Patterns

D_1: Status quo, 300 million population by the year 2000

D_2: Extreme urbanization

D_3: Population dispersion; pastoral

D_4: Like D_3, but technological and connective

World Population Subsistence

H_1: Optimistic, "Green Revolution" a success

H_2: Like H_1, but technical failure of Green Revolution

H_3: Like H_1, but Green Revolution negated by violence

H_4: Reductions in help to developing nations

H_5: Population stabilization without Green Revolution success

U.S. Foreign Relations

F_1: Status quo

F_2: Only AID involvement in underdeveloped world

F_3: Selective AID Military involvement in underdeveloped world

F_4: Isolation regarding underdeveloped world; involvement with developed nations

F_5: General isolationism

F_6: "Manifest Destiny"

the first, illustrative CUSP analysis, and Exhibit 1 offers an expanded description of one of the 33 factors.*

After various trials, it has been decided that it is best to seek no more than about six sectors, selecting aspects of life that might serve as independent variables in less holistic kinds of analysis and with the set tailored in terms of the perceived character of the futures tree to be encompassed and the policy uses to which the finally refined projections are to be put. We now are convinced that the aim should not be to spread the categorization so wide as to include all significant aspects of life; rather, it should be to designate clearly a half dozen aspects that might serve to describe the core structure of many different possible future conditions. Skeletal significance rather than comprehensive coverage is the main point in selecting sectors, i.e., the sectors should name the first half dozen or so topics that one would want to have covered in a brief description of an overall situation. Specification of a condition within each of them and a few others would go far toward designating the core characteristics of some arbitrarily conceived future condition.

There always will be candidate sectors that could be added to the list after a total of six or seven have been reached, but to do so would increase the complexity of the subsequent manipulations to such an extent that it seems wise to limit the number and therefore the comprehensiveness of coverage as has already been suggested. Experience suggests that radically different sector lists will prove appropriate for significantly different geographic scopes. At least, the constructs that proved useful in projecting worldwide alternatives (the Projected World Pattern series--PWPs) were much different from those that are emerging out of successive

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* Johnson Research Associates RM 69-3, op. cit.

Exhibit 1

SINGLE-PARTY GOVERNMENT

Such a pattern of government in the United States almost certainly would be associated with increased centralization and with increased penetration of government into each citizen's life. The degree of democracy would drop sharply, but that which remained might be relatively direct, and there probably would be intensified emphasis on law enforcement whether the ruling clique were of the left or right. Ideological fervor would tend to be high.

Explicit dictatorship, with its effective abolition of elections would be one possible condition here and would be especially probable if the pattern were to persist long enough to undergo much internal evolution. The pattern might well start as a sort of Caesarism, however, with the electorate voting itself into the hands of a tyrant (in the relatively non-invidious usage of ancient Greece) in order to allow the government to try to cope with pressing problems without being burdened at each step by a carping opposition. Under such a condition, election might be continued, with voter selection limited to those candidates approved by the government. Politicized crime might remain at moderate levels, but a more likely result in a country so accustomed as this one to actual choices would be one in which goon squads in the service of "Caesar" would try to seek out and quiet potential dissidents before their protests might surface in embarrassing ways.

cycles of analysis of the CUSP problem. The list that proves best for the United States may or may not prove most useful for corresponding projections for the USSR, for instance, or for East Asia or South America, but we would expect more similarity than was found between the world and national scales of attention. Projections for a local area (e.g., the San Francisco Bay Area, or the U.S. Northeast Triangle from Washington, D.C., to New England to the Great Lakes) are expected to call for other, distinctive sector rosters.

Within a given sector, factors are chosen in an effort to gain complete schematic coverage of all plausible alternative conditions. For example, if "economic structure" is among the sectors chosen for use in skeletal description, the factors within it should be such that we may typify any remotely plausible future U.S. pattern in that dimension by the selection of one factor from the sector. The scope of the field to be covered by factor selection with a sector, therefore, is set by a perception of plausibility (a perception that remains relaxed in early FAR cycles so that apparently remote possibilities will not be rejected, but which tends to tighten in later cycles in order than more plausible alternatives may be more discriminately handled). Within that boundary, all alternatives are to be covered somehow again with about half a dozen or fewer factors if possible.

Even when projections for some other region or country seem to require the same sector, it can be expected that new factors within that sector will have to be planned. For example, the factors describing plausible alternative economic structures within the United States, the USSR, or the Matta Grosso during the next few decades are not likely to be the same.

Also, it must be noted that both the sectors and the factors, and especially the latter, are not defined at this stage of analysis. In contrast, they are nick-named and clarified through example, i.e., the

characteristics of a given factor never may be derived from the name given it; the process is the reverse, with the nick-name emerging as a sort of shorthand notation with which to designate a restricted but still almost infinitely variagated portion of a complex social field. Exactly what is meant by a given factor within a specified sector can never be approached except within an embracing context of the sort provided by the whole-body projections to be described in Step 4. The factor names come closer to precision as the cyclic process of analysis progressively reduces the frequency and "size" of anomalies; then, the context from a previous Step 4 projection will conform more closely to the usage of the Step 2 constructs, and meanings may be sharpened correspondingly.

Step 3: Manipulation of Sectors and Factors

Possession of a set of sectors and factors tailored to the region, time frame, and policy field of concern facilitates interior comparisons and briefing display of results, but it also helps in the generation of those results. In subjective inquiry, such as the projection of future alternatives must be, routine aids to help in overcoming prejudices and in comprehensive exploration of alternatives are highly important, and the FAR constructs are composed to help in such ways. The routine described in this section has grown from the CUSP analyses, but it appears to serve much more generally. Whether the objective of research is to project sweeping alternative patterns of life within some region or to project more detailed alternatives within a policy field or institution, the sequence of analysis described below seems likely to serve well. In each of the four steps within the cycle being described, it is important that conditions within the region of projection be considered in relation to those outside. It seems especially desirable that the manipulations of Step 3 be performed with reference to some particular set ambient

circumstances. For example, each group of projections for the United States (CUSPs) for, say, the next 30 years should be made with specific reference to a particular projection of worldwide developments over the same time frame. Where a bracketing set of such projections is available (as in the PWPs), the manipulations of Step 3 should be performed separately for each member of the set. Subsequent consolidation can bring together the materials that have been generated through such sequenced attention to alternative ambient patterns. If the field of projection were a region or an institution within the United States, these manipulations would be performed for each of a selected set of CUSPs.

The Matrix of Pairs. This is the most nearly mechanical of the operations to be performed, and even here the individual judgements called for are holistic rather than strictly logical. A square matrix is constructed using the full list of factors along both the vertical and horizontal sides. For each of the squares in that matrix, the question then is asked, "For the assumed pattern of external events, would these two factors seem to fit concurrently within any plausible situation within the field of projection?" A "Yes," "No," or "Maybe" answer is entered for that square, and attention is shifted to a different square. Only half the matrix needs to be completed since it would be the same on both sides of the diagonal. A "Yes" is a relatively definite response and, oddly enough, is not especially useful, for reasons to be described. "Maybe" is ambiguous, since it might mean, "The members of the group have opinions on this but are unable to agree," or "No one had any clear feeling on this one, in either direction." "NO" is the most important entry, since it asserts a group agreement that no internally consistent pattern was visualized in which the pair of factors in question would fit, and such a judgement casts a wide shadow of negation. It should be noted, however, that the basic question asked for each pair is an open ended

one, and the "NO" answer might be translated as, "I've not yet thought of a case in which these two would fit."

Figure 6* illustrates the kind of matrix under consideration. This example is imperfect in two respects. First, when it was filled out the research team had not realized the advantages of working with one ambient context at a time. The matrix was filled out with only general attention to the external world, the operative question being, "Can we think of a condition wherein this pair of factors would fit;" as a result, relatively few "N" assessments were made. Second, when the matrix was run, a five-unit scale of plausibility was used--"No No," "No," "Maybe," "Yes," and "Hell Yes;" experience since then has suggested that such refinement is counterproductive. Once the pairs matrix has been completed for any given embracing context, the next step is to select all of the full configurations for which none of the contributory pairs were given a negative rating in the matrix. For any given configuration involving six sectors, there are 15 different factor pairs to be considered, all of which must have been rated non-negative for the configuration to survive as a whole. For example, the configuration $E_1I_1W_3D_1H_1F_2$ survives because each of its 15 pairs† were judged to be tolerable coexistent in some PWP, but the configuration $E_3I_1S_1D_1H_1F_1$ was rejected because at least one of the pairs

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* Drawn from 1969 CUSP results, Johnson Research Associates RM 69-3, op cit.

† E_1I_1 I_1S_3 S_3D_1 D_1H_1 H_1F_2
E_1S_3 I_1D_1 S_3H_1 D_1F_2
E_1D_1 I_1H_1 S_3F_2
E_1H_1 I_1F_2
E_1F_2

	$E_1E_2E_3E_4E_5E_6E_7$	$I_1I_2I_3I_4I_5I_6$	$S_1S_2S_3S_4S_5$	$D_1D_2D_3D_4$	$N_1N_2N_3N_4N_5$	$F_1F_2F_3F_4F_5F_6$
U.S. Economics						
E_1: Prosperous, free-enterprise	Y Y M N M N	YYNNYMM	Y M N YY	Y M M N Y	Y M M N Y	Y Y Y N NN Y
E_2: Slow growth, free enterprise	M Y Y N M M	N M M M Y	M M N M	M M M Y M	N M M M Y NN	
E_3: Depression, free enterprise	N Y N M N M	NNY N M N	M N Y N	N Y M YY N	NN N M M YY NN	
E_4: Prosperous, government control	N Y Y M N Y	Y M M M Y	Y M N M	Y M M N Y	Y Y M M NN Y	
E_5: Unsuccessful, government control	N N N Y N M	N Y M M N	M M N M	M M M Y M	N M M Y M NN	
E_6: Non-expanding, successful	Y N Y M N M	N N Y Y Y	N NN Y M	M M M M M	M M N N NN N	
E_7: Commonalism	N NN Y N Y M	N N YYYM	N NN Y Y	M M M Y M	N N N M M NN	
U.S. Internal Politics						
I_1: Status quo		YNN Y M M	Y M N M	Y – M M M	Y Y M N N Y	
I_2: Increased federal power		Y M M N Y	Y M NN M	Y – M M Y	Y M Y M M Y	
I_3: Increased state/local power		N Y M M N	N Y YY M	N – N YY M	N M N Y M N	
I_4: Single-party government		M YY M N M	M M N M	M M M M M	N M M M M M	
I_5: Direct democracy, multiparty		N N Y M M	M Y M M	N M Y Y M	NN M N M M N	
I_6: Cybernetic bureaucracy		Y M M M M	M M N M	Y M YNN M	M M M N N N	
Science and Technology						
S_1: Rapidly expanding			M M NN Y	Y M M N Y	Y Y Y N NN Y	
S_2: Stasis, elite security			N M Y N	N N M YY Y	NN N N M Y NN	
S_3: Scientific stasis; technology applied			M M M N	Y M M M Y	Y Y Y M M N	
S_4: Active; emphasis on behavioral science			M M M N	M M M M M	N Y N M M N	
S_5: Active; antipollution			M Y N M	M N M Y M	N M M M M N	
U.S. Demographic Patterns						
D_1: Status quo; population increase				– – – – –	– – – – – Y	
D_2: Extreme urbanization				– – – – –	– – – Y – Y	
D_3: Population dispersal				N – – – –	N – – Y – N	
D_4: Like D_3, technological connectivity				– – – N –	– – – N – YY	
World Population/Subsistence						
H_1: Green Revolution O.K.						Y Y M N NN Y
H_2: Green Revolution; technical failure						M M Y M M M
H_3: Green Revolution; disorder, administration lapse						N M Y Y M N
H_4: Green Revolution; reduced help from D.						N NN M YY YY NN
H_5: Green Revolution; "Boot Straps" population stabilization						M – M N N M
U.S. Foreign Relations						
F_1: Status quo, antic.						
F_2: Only AID to underdeveloped						
F_3: AID/Map, selected underdeveloped						
F_4: Isolation regarding underdeveloped						
F_5: General isolationism						
F_6: "Manifest Destiny"						

FIGURE 6 A MATRIX OF PAIRS

(E_3F_1) had to be judged a "No."* Actually several other pairs in the latter configuration also are suspect, but one negative is enough to invalidate the whole. This is a purely mechanical step so it may be performed by a computer using simple program that is especially desirable as the matrix drill is repeated successively for several embracing contexts.

This process is a highly efficient filter. If the matrix were composed of six factors for each of six sectors, each "No" assessment would remove nearly 1300 configurations from consideration. Such negative assessments are not independent, so their shadows overlap extensively. Even the relatively large number of "No" ratings to be expected when the whole matrix is run for one particular PWP as its external setting still leave many surviving configurations.

Holistic Consideration of Nominally Self-Consistent Configurations

The configurations that survive the mechanical filtering after the assessments within the pairs matrix are only nominally self-consistent. One of the surviving pairs within a given configuration might have been judged to be non-negative only in the near future while others might have been felt to be plausible only toward the end of the century, so that the configuration as a whole would not fit at any one time. It would be possible to move beyond the treatment of pairs to that of trios and quartets of factors within the configurations surviving the initial filtering, but experience so far suggests that such elaborations would be equivalent to reading into this stage of analysis more significance than it deserves.

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* E_3 corresponds to a relatively deep economic depression within a "free enterprise" pattern, and F_1 reflects a foreign policy as vigorous and international commitments as extensive as was the case in about 1960. The two conditions seem incompatible for any plausible pattern of life for this country in this century.

It should be recalled that this whole manipulation of the schematic sector/factor constructs is intended not to derive alternative future conditions but rather to direct the analysts' attention toward a full array of interesting and potentially significant alternatives. The final judgement should be holistic, and work indicates that inspection of entire configurations (and group discussion of the reasons why they might or might not be kept within the roster of plausible wholes) is appropriate at this stage.

When such assessment has been completed, there are likely to be only about 50 to 100 survivors, classified (because of the way in which they were developed) according to the PWPs in which they seemed most plausible.

Formation of Indicative, Outline Scenarios. As a final manipulation within the FAR method as it has been developed to date, the configurations that have been judged to provide schematic, skeletal designations of plausible societal conditions are strung together along possible lines of development. There can be no set way of doing this, but several procedures help. It is useful, to see which configurations seem most credible for the near future and present, for the closing years of the time period of projection (for the CUSP work, 2000 A.D.), and for intermediate years. After discussion shows reasonable concurrence on such classifications, it has proven effective to start from each late-maturing configuration and to work backwards through one or more of the intermediate ones to a smaller number that seems to offer descriptions of the present. Corresponding excursions of imagination starting from the present and working forward also improve comprehension of the whole field, as do efforts thereafter to fit unused configurations into some of the sequences already constructed or to construct ones into which they may be fitted.

Not all of the configurations need be accommodated. A pattern that is nominally plausible in isolation still may not seem to fit within any plausible story line running through the present from the part and may be rejected; besides the projections sought are to be illustrative rather than exhaustive of plausible alternatives. However, it must be clear from the foregoing description that the steps of analysis are not definitive, and it always has proven to be the case that the task of drawing outline scenarios uncovers configurations that had been judged earlier to be implausible but which clearly qualify for consideration once a sequential pattern has been developed within which to place them. Since their earlier rejection had no more basis than an estimate of lack of fit, they may be replaced on the list of candidate conditions when later consideration in a more fully elaborated context exposes places where they might fit.

Other Manipulations. The heuristic objectives of Step 3 might be served through several other manipulations, and some are suggested later in this report in connection with possible extensions of the basic method, but there are reasons for not inviting too much elaboration in steps. Orderly, logical treatment of component parts of wholes is relatively easy, offers the kind of readily visible product that adds mass to reports, and fits seductively the tastes and skills of many researchers; it is too easy to divert an inordinate fraction of the total available effort to such activities at the expense of essential syntheses. Such diversion is especially undesirable within the FAR cycle because the manipulation of parts is not intended to produce any results that are valuable in their own right and are, rather, entered into to broaden the holistic work to come and to make it easier to teach others the results of such work.

Step 4: Projection of Individual, Whole-Body Scenarios

Steps 4 and 1 merge and overlap to a considerable extent at all stages after the initiation of the first cycle, i.e., one attends to and refines his appreciation of the whole set of alternatives before him while pursuing each individual step. There is a significant difference between the two, however. It is highly desirable that each projection be pursued at least part of the time with no lateral attention to others, so that its author may become engaged in that particular sequence of complex changes. The flow of societal changes within one scenario should assume a kind of autonomy, somewhat as the characters of a good novel take the narrative out of the hands of its author. After such relatively isolated creation, however, experience has shown that there is much to be gained by comparing what might be called adjacent scenarios. It often develops that events or associations postulated for one story line really seem to fit better in another, and since the ultimate objective is to have a plausible set of alternatives it often seems wise to adjust the singly created scenarios in such cases. There is an interior cycle at work between Steps 1 and 1 in which initial versions of individual scenarios are adjusted after consideration of the set as a broader whole, and so on until both the separate stories and the set composed of them seem consonant.

There are many ways to engage in the creative writing of a scenario; all that can be done here is to list a few suggestions. One starts within the sequence of activities described here, with an existing sense of the whole field of alternatives from Step 1 and with outlines from Step 3. The latter prove to be much richer than might be supposed from the paucity of symbols available within the sector/factor set. The past should be revicwed to offer a plausible line of transition into the alternative version of the present that seems most consonant with the

outline to be pursued. Events and stakeholder interpretations of events may be assumed that would account for the near future trends being postulated and, especially, to help explain the changes in factors that are represented by transition from one configuration to another along the time line. In current work, it has been found useful to start with a relatively detailed description of the present and near future, to work through a relatively skimpy sequence of plausible events to a "bench mark" period a third or half-way through the period to be covered eventually, and then to describe conditions projected for that bench mark period in detail. Considering each sector and the assumed factor within it in a standard sequence will facilitate later comparison. After that, following a similar pattern, one may work out to the next bench mark period and so on until the period for projection has been covered. It is wise to order and space (and add to or subtract from) the lists of illustrative events suggested for periods between bench marks, using comparison with adjacent scenarios as one type of guide to insight.

Selection of illustrative events is governed by taste and imagination, but one valuable source is provided by existing forecasts of various kinds. Such forecasts, however, often have been concluded without reference to the rich kind of ambience provided by scenarios such as those being constructed here, so it is well to undertake an independent review of their plausibility in the particular setting offered by the scenario. In particular, it seems likely that the spread to be found in various Delphi estimates of the times when specified inventions might occur is partly to be explained in terms of differences in the contexts assumed by respondents. It is not illogical to assume that such events should be written into a scenario rather early (i.e., toward the early side of the time interval in which respondents guessed that the event in question might occur) in technologically successful scenarios and later

or never in those where the impulses toward and the resources for such invention are projected to be more scant.

The process within Step 4 is highly subjective and mostly qualitative. Considering the nature of the problem (and the impossibility of unequivocal prediction and the inherent requirement for the use of gestalt appreciation as the only tool finally broad enough to meet the problem), this is not viewed as a fault, but it does appear that further analytic treatment would be possible. The character of such possible treatment and questions relative to its cost and value will be considered toward the end of the report, when possible extensions and adaptations of the existing FAR method are considered.

Lessons Learned

Several of the detailed steps of analysis described were not applied in that manner to date. The method as described is the one that we think should be used; it is not always the one that has been followed. This section considers some of the more notable disparities between past procedures and present recommendations and the lessons learned by having pursued certain parts of the work in what are now thought to have been nonoptimal ways.

The Importance of Embedding Each Projection Within a Specific Broader Context

The pyramid of successively embracing contexts must be topped off somewhere. The human environment now effectively ends a few hundred miles above the earth's surface, and nonhuman contexts were not taken into account in the development of the Projected World Patterns. Various religious and mystical schools would argue against such a decision, suggesting that there is, external to our world, that which treasures us or

revels in our pain or controls us in ways indifferent to human goals or fears. This work has been conducted in the belief that externals need not be considered in our projections, and that the pattern of human life on earth may be taken as the most inclusive context with which to be dealt. The starting point was the development of alternative futures for the whole world. In existing sets of holistic projections, the existing PWPs form the only candidate set, although they are becoming dated.

Successive projections for smaller portions of the whole should, however, be made with understanding of the broader context. The first round of CUSPs were projected with only a general, overall attention to the PWPs, but it has been realized more recently that within so loose a structure of research constraint we stayed wishfully inattentive to world alternatives within which international strife might seriously curtail the future options left to Americans. And yet, unfortunately, such alternatives remain too plausible to be rejected prudently. Therefore, it was concluded that a more reliable course for projections at any given geographic scope would be to consider previously developed, inclusive alternatives one at a time and thus within each such broader pattern seek for plausible alternatives in the field selected for projection.

For projections covering the United States, a fresh and comprehensive look at plausible alternatives should be made within each PWP, one after another, until the list of plausible world alternatives has been exhausted. Correspondingly, for any projection of a region interior to this country (e.g., California, the Northeast Triangle, or Texas), reference should be made explicitly to each CUSP deemed plausible and relevant enough to engage the serious attention of a prudent planner. This procedure of working down from single, whole, alternative, embracing contexts is the one that was described for the FAR method in the previous section; we were led to it by the cost of having failed to do it.

Having been so led, it was seen to offer unexpected opportunities. First, and probably most important, this cascading approach, as illustrated in Figure 7, promises steady enrichment and review of existing projections. The CUSP projections will, when identified with particular PWPs, force closer attention than has been the rule to such worldwide projections and will add depth and quality to each of them as more detailed U.S. alternatives are developed. If opportunities present themselves to make parallel contingent projections for places such as the USSR, Japan, or Western Europe, each such venture will profit by the increased depth of the PWPs and will add to that depth. Correspondingly, so will the individual CUSPs be strengthened as intranational projections are made within each of them. This promises a kind of accretive quality for research conducted using the FAR method that has been absent within the social sciences.

Second, at the same time that the above advantage was noted, it was realized that the identical steps of analysis described earlier for use in the projection of alternative overall patterns of life within a given geographic field could be used as well to project more detailed alternative patterns for institutions and policy fields within that area. For example, the family of institutions of publicly funded teaching in the United States can be described in terms of sectors and factors tailored for that purpose and selected according to the rules in Step 2 of the FAR method. That task is now being pursued within the current CUSP analyses within the Educational Policy Research Center. While the list of sectors to be used has not yet been fixed, a sample set is shown below illustrating the kind of entries to be included.

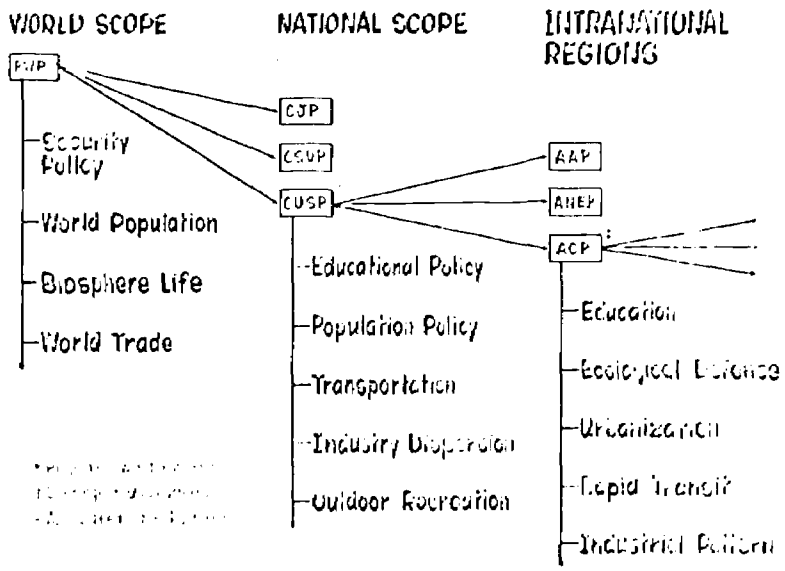

FIGURE 7 NESTED CONTINGENT PATTERNS

SUGGESTED SECTORS TO BE USED IN THE PROJECTION OF ALTERNATIVE EDUCATIONAL FUTURES WITHIN EACH CUSP

Access	By grade level, socioeconomic class
Management/Funding	Including voucher plan alternatives
Purposes/Aims	Profiles of intent among policymakers at all echelons
Mode	Factors of which items like the following would be descriptors: teacher/student relation, location, salient techniques, media involvement
Vehicle	Profiles of extent to which publicly funded teaching/learning is accomplished within school, home, by TV tube, etc.
Subject Matter	Profiles of curricular content.

Once available, such constructs may be manipulated as in Step 3 to perform morphological expansion of possible alternative configurations and to filter and order such schematic designations of conditions to provide indications of plausible alternative lines of evolution of such institutions within each CUSP, successively. Again, accretion of comprehension is promised by the way in which elaboration of institutional alternatives within each regional projection will elaborate and reinforce such embracing contexts.

The Preferred Character of Sectors and Factors

Two nonoptimal approaches to sector/factor selection were made during the CUSP analyses of 1969-70; each produced valuable and directly usable results, but experience suggests that a concept appropriating some of the characteristics of each of those approaches would be superior to

either of them. Also, there were some fruitful guesses made early in the analysis.

The study of sector/factor selection was minimal during the earlier work on the PWPs, since the chief issues concerned the alignment and power of the many countries and notable regions on earth; the curious fictions of international law that make all nations equal forced attention to the "whereness" of all the places being considered. The map of the world became the dominant construct, both for the conduct of the research and for later dissemination of results. When attention was given to the relatively homogeneous field offered by the United States, however, map locations no longer could serve as a primary basis for analysis and the initial formulation of the present FAR method was undertaken to meet the needs of the CUSP work. Only later was it realized that the method was so generally applicable as now seems to be the case.

The initial CUSP approaches were reported in detail in late 1969.* An effort was made then to select structurally significant dimensions of existence in the United States as sectors, with only informal attention to more heavily valuative aspects of our culture. This selection was made for several reasons, chief among them being that an opposite assignment of attention had focussed research within the EPRC on valuative aspects of life during the period before the JRA/SRI team was formed. The sectors chosen were: economics, internal politics, science and technology, demography, worldwide hunger, and U.S. foreign relations. Factors, were chosen within each sector to typify plausible colloquially identifiable alternative, 1970-2000 conditions within each, and the specification of one such factor within each sector provided a configuration of the kind needed for skeletal designation of a single set of conditions

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* Johnson Research Associates RM 69-3, op cit.

entailing all six sectors. A possible condition could be indicated by a single "word" of the form, $E_e I_k S_s D_d H_h F_f$, where the lower-case subscripts represent factor designations.

We decided to limit the number of sectors and factors within each sector to about six categories in each case because of implicit understanding gained from years of analysis. The value of the choice quickly was made evident as the work began. It later was noted that tests had shown that the number of disparate bits that a human can retain easily in mind is about six and seems to be one of the least variant parameters measured by psychologists. In any case, use of the sector/factor array shown in the 1969 Factors Roster quickly resulted in the study team's development and application of a remarkably powerful in-house language.

Initial discussions of the plausibility of coexistence of specific factor pairs (the matrix of pairs) led the members of the team to an improved comprehension of the scope and applicability of each factor, while it proved also to be an effective way of focussing attention on a particular topic at any given time--many of the extraneous arguments that plague all social science discourse washed away in this analysis, apparently because all parties to the discussion agreed rather precisely on their topic. Comments such as, "That's an $E_4 I_4$ kind of pattern" became common in just a few days, as the analysts began to compress their communications with each other. Then, when it came time to "gestalt" the configurations (i.e., to see how they "felt" as wholes) that had survived the mechanical filtering of the matrix of pairs, the analysts were seen quickly to drift into modes of comparison and association that would have been impossible if the entire taxonomy had not been held entirely in mind. We now feel that such familiarity could not have been gained so quickly if the limit of a half dozen had not been accepted for each kind of category. A later stage in "language" composition that was observed came

when the group began to make statements like, "Dammit, a #212 pattern can't come as soon as that after a #101," where the numbers stood for whole configurations. Indeed, the author had the curious experience of withdrawing from the discussion group for a few hours (to draft an account of results just achieved in the selection and numbering of configurations to be retained) and returning to find the group engaged in flashing comparisons of the sort illustrated by the last quotation and doing it in a language incomprehensible to him. It took only fifteen minutes to catch up, however.

If the limitation to six items proved a fruitful decision, however, the rejection of the more valuative aspects of the U.S. culture now appears to have been a fault. Unfortunately, the method chosen to repair it now seems to have required more time than should be assigned to Steps 2 and 3 in the FAR approach, although it did prove richly instructive to those who pursued it. The character of this attempt can be discussed in relation to Figure 8. The six original sectors are shown as the outer rim of the circular field mapped there, while the six sectors mapped within that rim were used as the bases for a repetition of FAR analysis already completed and leading toward a "values tree" to be compared or merged with the "constraints/opportunities tree" that already had been sketched starting from the orginal six sectors. For convenience, the terms "inner circle" and "outer circle" will be used to refer to these two threads of analysis, which were pursued at the same time by two different groups (with some overlap of personnel) but which were not synchronized in terms of the FAR cycle.* The following list indicates the sector/factor roster for the inner circle analysis.

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* This exposes another "lesson learned" that may be covered in this brief note. If the FAR approach is to be used at all, it seems wise to adhere to its cycle as closely as possible and to avoid overlapping,

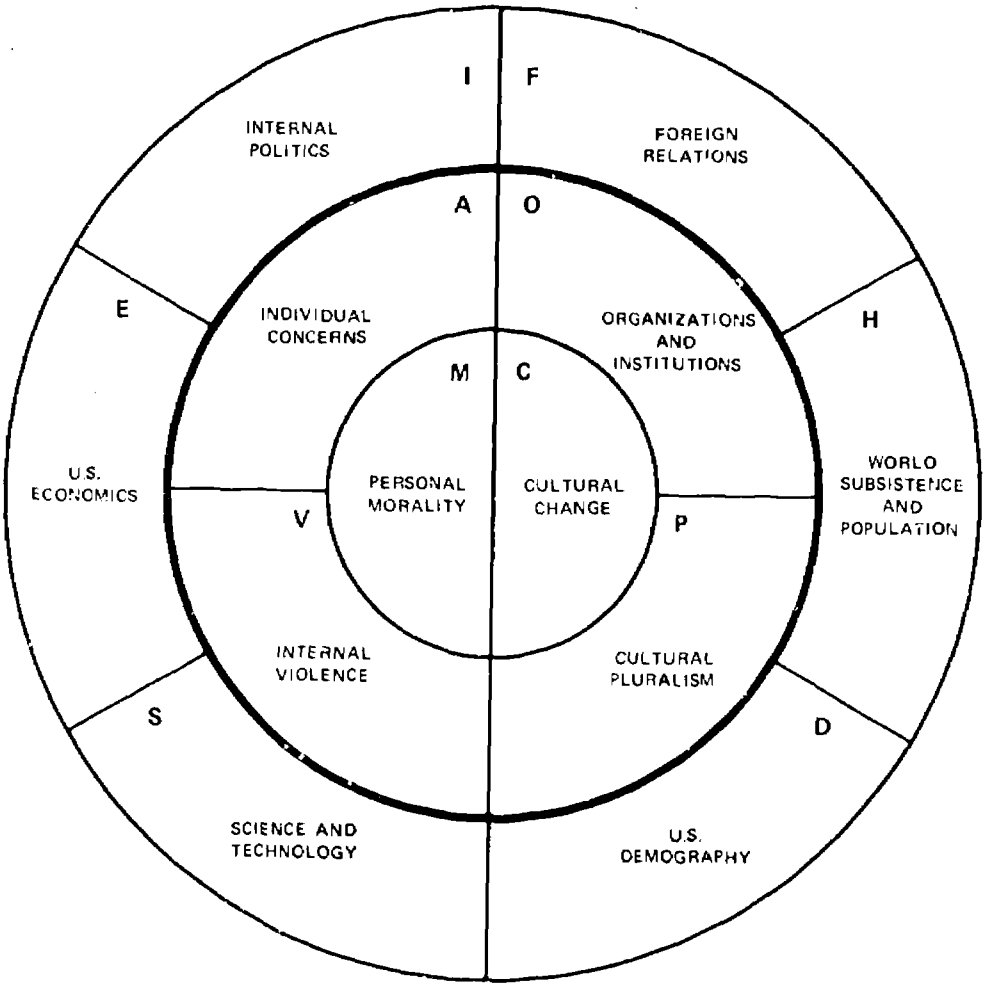

FIGURE 8 ASPECTS OF U.S. SOCIETY FOR GENERATING ALTERNATIVE FUTURE HISTORIES

FACTOR ROSTER: "INTERNAL" SECTORS
(1970)

FACTOR ROSTER: "INTERNAL" SECTORS
(1970)

P: Cultural Pluralism

- P_1: Uniformity
- P_2: Nonplural diversity
- P_3: Unified pluralism
- P_4: Nonhostile pluralism
- P_5: Hostile pluralism

V: Internal Violence

- V_1: Sporadic crime
- V_2: Pervasive apolitical violence
- V_3: Visible, low-intensity insurgency
- V_4: Covertly supported, low-intensity insurgency
- V_5: Higher intensity insurgency
- V_6: Private armies

A: Profiles of Personal Concerns ("A"ims)

- A_1: Anxiety, individual solution
- A_2: Anxiety, collective
- A_3: USA 1965
- A_4: Achievement orientation, individual
- A_5: Achievement orientation, collectivity
- A_6: Apollonian calm
- A_7: Person-centered unfolding

M: Personal Morality

- M_1: Punishment oriented
- M_2: Opportunistic pragmatism
- M_3: Approval oriented
- M_4: Fixed social order orientation
- M_5: Contractual social order orientation
- M_6: Transpersonal orientation

C: Cultural Transmission and Change (E = Enculturation, A = Acculturation)

- C_1: Uninhibited change (E-,A+)
- C_2: Moderated change (EO,A+)
- C_3: Neutral (EO,AO)
- C_4: Assimilated change (E+,A+)
- C_5: Conventional (E+,AO)
- C_6: Tradition-controlled (E+,A-)

O: Organizations and Institutions (P = Pervasiveness, C = Control external vs internal, S = Strength

- O_1: Strong mandatory ($P_1C_1S_1$)
- O_2: Weak mandatory institutional orientation ($P_1C_1S_2$)
- O_3: Strong homeostatic institutional orientation ($P_1C_2S_1$)
- O_4: Weak homeostatic institution orientation (relaxed norms) ($P_1C_2S_2$)
- O_5: Nonsilent minorities ($P_2C_2S_1$)
- O_6: Laissez faire ($P_2C_2S_2$)

Neither the inner circle nor the outer circle analyses were conducted in isolation. Each considered the field of concern of the other only in a casual way, however, much as the initial work had dealt with worldwide contexts. During the outer circle work, we did try to keep in mind the cultural flavor, but such aspects of the whole proved to be too easily forgotten in the midst of the analysis. Correspondingly, during work on the inner sectors, we tried, unsuccessfully, to attend at all times to issues of feasibility and opportunity. The issue is much the same as that which underlay the lesson learned concerning the treatment of external contexts. In any process of inspection of alternatives as rich as this one, it seems clear that aspects of the problem left to casual processes of review are vulnerable to the unconscious selectivity with which every person approaches the universe of alternatives about him. We are too capable of self-deception to be trusted to deal in a balanced and continuous way with an amorphous field of alternatives.

Nothing can defend us against such transgressions, but a "drill" that makes us consider a series of items in a regular, methodical way can force us often to attend to that which we otherwise might comfortably have disregarded. On the basis of work to date, the sector roster should include salient aspects of life from both the inner and outer circles of Figure 8 so that such diverse fields must at least be treated within the analysis as being equally and concurrently interactive. It was the experience described above that led to the conclusion that the FAR sectors should be limited to about six entries and should include the more salient

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simultaneous work at several different steps. Such overlap weakens the between-cycles comparisons at each step hat are important in gauging the rate of convergence (or degree of completion) of the study, and there seem to be too few compensatory advantages of dissynchronous treatment to offset the confusion that it can cause.

aspects of life, drawing both from the inner and outer fields. The sectors are to cover a restricted, but balanced, set of key dimensions of description, but they cannot cover the culture fully, and any attempt to achieve such comprehensive coverage will vitiate the FAR method.

The foregoing has been related to sector selection only, but the same body of experience led as well to a much improved comprehension of what factors must be like to make the method work effectively. If, as is required in the FAR concept, the roster of all possible configurations from the sector/factor list is to include all those cases that might merit detailed attention, the factor set within each sector must offer filing space to any plausible condition within that dimension of description.

This invites the use of topological representations of the type made by Kurt Lewin, wherein the field within a sector is mapped into a small number of subdivisions. The factors are subdivisions, and if they have been laid out skillfully and insightfully, any plausible variant within the field of description of the sector in question can be designated by locating a point on the map of factors. Changing conditions within that sector may be described in terms of the motion of a point within and on its factor map. Furthermore, while there is no general assurance that it should be possible, it does prove in practice that one can make plausible use of the structure of such a map and especially of the adjacency relations exposed. That is, it usually is possible to map the factors in a way such that alternative conditions A and B may be drawn with a common boundary if a transition directly from one to the other seems plausible; if, however, it would seem more likely that transition from A to B would have to occur with the condition represented by factor C being occupied en route, then C would be drawn to interpose between A and B. If either route (i.e., directly from A to B or moving from A to C to B) seems plausible, that too may be shown on the factor map.

Lewinian mapping has been used so far in this work only in sporadic ways and only to aid the analysis in comprehending the character of the factors being used. It seems possible, however, that such representation might prove useful in later analyses of sequential plausibility within scenarios, a use to be discussed when untried extensions of FAR are considered.

The Balancing of Attention to Wholes and Parts

This last lesson to be discussed is the most important. The holistic projection of scenarios and their composition within an improved overall view of the future, in FAR Steps 4 and 1, merits as much staff time and expert support as the more routine operations under Steps 2 and 3. This was not realized during the planning of much of the 1969-70 work on the CUSPs by JRA and SRI, a fact that only became evident during scenario writing. A disproportionate share of the work was, accordingly, assigned to the selection and manipulation of sectors and factors. The bald statement of the issue almost suffices, but two nuances deserve attention.

First, the suggestion that equal attention be given to wholes and parts is just a first approximation to an answer that varies from one field of projection to another and that probably varies as one moves through successive FAR cycles within a given field. For example, it now seems probable that attention to sectors and factors should be relatively skimpy during an initial, rapid "pass" at any new set of projections--a first FAR cycle in which one's initial comprehension of the field would be converted rapidly into a sector/factor list and in which the list would be used with a minimum of interior searching to develop aids for construction of an initial set of scenarios. Scenario writing might require more work during the first, exploratory cycle. The suggestion of "equal time," therefore, is almost an evidence of lack of experience.

What can justifiably be said at this point, however, is that wholes are at least as important as parts within FAR; it is easy to minimize the importance of time spent in gaining and working with a holistic comprehension (as described for Steps 4 and 1 in FAR), and to do so will in most instances seriously detract from the worth and credibility of the results.

Second, as attention is increased on holistic (as contrasted with analytic) stages of inquiry, one also should consider the need for artistic (as contrasted with scientific or analytic) skills within the research team. Artistic skills, and especially those of the short story writer and novelist, evidently would be useful in the terminal presentation of results, but if the present concept for FAR future projection methods is correct, such skills should be used during the course of Step 4 and probably at other portions of the cyclic process. It might prove effective to call on experienced and proven writers of fiction for work on Step 4, but it seems probable that at least one person with such talents should be included within the central research team that remains intact throughout the number of necessary cycles of analysis and whose members concern themselves as a group with each successive step of analysis within those several cycles.

POSSIBLE EXTENSIONS AND NEW APPLICATIONS OF FAR

The current FAR method could be effectively used for the projection of a wide variety future contexts for decision or planning ranging from worldwide scope down to any locality that may be treated as a whole. Within each such contextual field, the existing method also may be used to project alternative patterns of evolution for institutions existing within that field, ranging from the sweeping policy field of education within the United States through such narrower concerns as those of Bay Area Rapid Transit and its impacts or to business-planning within the sociogeographical field in question. This offers a vast area of potential application, even without significant extension of the basic method. This potential is illustrated by Figure 7, discussed earlier. The lists of areas and institutions within areas for which projections might be made are much larger than those offered for illustration, and few have been processed.

Several possible improvements have been visualized, however, that would significantly extend and enrich the method, improving the quality of its results within its present field of applicability and extending that field's bounds. It does appear that few of these potentials are likely to be realized through improvisions achieved while applying the existing method to new projection fields. Such inexpensive gains were hoped for earlier in the present effort, but it now appears that exploratory projects, for which specific results cannot be guaranteed, will have to be mounted on at least the first two of the three innovations discussed in this section. For the third of the extensions suggested--teaching--there would have to be some specific project established, but

the achievement of desirable results is considered to be sure rather than problematical; the exploration would be concerned with how to be most effective rather than with the finding of some effective mode of application.

Tightening the "Relaxation" in FAR

To suggest that the FAR method might serve as a general means of studying social equilibria seems extraordinarily bold, but the prospect does seem bright. If it is to be realized, it now seems that the best route would be to sharpen the performance within FAR to bring it into closer correspondence with the much more exacting relaxation method as practiced in mathematical engineering. Discussion on this topic, therefore, starts with a summary description of such relaxation methods.

Most real problems, whether in engineering or in public policy are too complex to be solved in any closed, rigorous sense of the word. Science and reason have usually had to offer their help to practical decision in an intermediate region lying between rigorous determination of some optimal course and reliance on intuition. The most frequently chosen mode has been that of simplifying the real problem to a point so that it could be solved and of offering that answer as one more input to the fundamentally artistic, inner synthesis that must be used. In technical fields of knowledge, the combined advance of science and of the powers of mathematical analysis have been such that the practical problem often need be simplified only a little before they can be solved, and the resultant solutions often work well with only modes "smoothing" in the light of experience. Even in subjects in which the fundamental relations are as well understood as in stress analysis and heat flow, however, this approach (i.e., solving pseudo-problems and using the answers as definitive solutions to real ones) is not good enough, and in the social sciences it has failed abjectly.

Several intermediate forms of half solution have proved useful in the treatment of practical engineering problems that continue to defy closed solution. One of these associates a number of similar approaches under the name "relaxation methods."

Briefly, these methods pursue a process of successive approximations in dealing with field-type problems in which the fundamental relations at any arbitrarily selected interior/element are understood, but the boundary conditions are such that a closed solution is beyond reach. The particular format of approximation is one in which anomalous relations within one element after another are "relaxed" successively.

For example, if a stressed solid were the field under examination, an initial set of comprehensive assumptions would be made to the distributions of stress and strain throughout the field; conditions with each of an inclusive set of volume elements would be inspected sequentially to ascertain whether the assumed pattern of stresses and strains within each were such as to match the requirements of the physical laws governing the interactions. Where the assumed deformation (strain) was found to be different from that calculated from the correspondingly assumed stresses existing at that element, the deformation would be adjusted to bring it into accordance with the stress to eradicate the anomaly. Each adjustment, however, would create new, incremental disturbances in adjacent elements, which would have to be superimposed on the initially assumed distributions of stress and strain in the elements. Cycling a process through all volume elements a number of times will show (unless the choice of conditions or of the sequence with which elements are treated were unfortunate) a convergent approach to the true solution, with the anomalies to be relieved growing smaller and finally dropping below whatever threshold of imperfection may have been set as a criterion of "good enough."

Essentially similar methods work well in the treatment of problems as desperate as those of heat flow and climatology. There are many opportunities for cleverness within the description of the process given. In particular, it should be realized that approximations still are needed--that the behavior even of a simply formed volume element such as a small cube is odd enough under a six dimensional* stress field so that the process must be stylized to some extent. Corresponding problems emerge in other physical problems that have yielded to relaxation methods of analysis, but in each case the issue falls within the class of problems for which it has been found a rigorous solution of the simplified problem for the differential element works well enough in practice to provide a sound basis for decision.

A simplifying condition usually exists in most of the physical fields in which relaxation methods have been applied, namely the constancy of the elemental relationships among the variables, independent of either location in the field or of the overall field configuration. The stress/strain relations to be considered do not change from one coordinate to another in most stress analysis nor are they altered if the shape of the stressed solid is changed. This would not have to be the case, however, since the relations can change (e.g., if the elastic limit is exceeded locally). Correspondingly, in fluid flow problems, the decision whether to use equations representative of laminar or turbulent flow sometimes must be a tentative one until after the solution has been finished, and many of the estimates of flow patterns around airfoils have to be conducted using relaxation methods specifically because such uncertainties prevent the sort of closed solutions that otherwise would be possible.

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* Three dimensions of tension/compression and three of torque.

In social and psychological fields, variability of elemental interior relationships among variables is the rule rather than the exception. This variability demands that any analysis of these fields must involve an alternation between the whole and its parts, with sensible treatment of either being impossible without serious consideration of the other. Gestalt psychologists make this point (for personality fields) the core of their approach, and anthropologists do much the same (for cultural fields). While there are some kinds of intrapersonal and interpersonal relationships that may not show this particular kind of involuted complexity, they seem to be special cases. It is wise to assume for social fields that the characteristic rules governing localized relationships among their variables are affected significantly by the overall patterning of the whole, to be modified if that whole changes or, in the case of analysis, to be modified if examination of component relations suggests that the whole were different from that initially assumed as an embracing context for such examinations of its parts.

An analogy, first proposed by Kurt Lewin, fits. He suggested that the task of one who would study a social field is much like that of a man who undertakes to design a road system for an unsurveyed continent--with few roads to start with and constrained to make all of his own surveys from the roads he finds or has built. Such a designer, if he is sensible, first probes his continent with cheap trails, making his initial choices either at random or on the basis of gross knowledge or rumors. From such preliminary probes (the counterpart of initial "cuts" at a social field problem), he gets a much improved knowledge of the probable structure of the land and the economy that justifies more ambitious plans and explorations--which lead in turn to improved bases for planning, some rejections of false starts and worthless investments, and a recycling of the whole process. This example, however, somewhat

underemphasizes the interior variability of the rules of interrelationship, although Lewin himself spent his career in insisting on that variability.

Where many local interrelationships in physical fields may be dealt with quantitatively, most of those in social fields can only be handled qualitatively, now or in the foreseeable future. One response is to deny the usefulness of any kind of rational inquiry into such problems. Another may be to proceed and calculate anyhow, partly out of habit and partly as a sales gimmick, even though credence can only be placed on the results of such calculations if they pass the tests of commonsense that could have been substituted for the numbers game in the first place. A third response (in contrast to these two exaggerated extremes) is the ordered treatment of one component of a social field after another, informed by an initial concept of the whole and conducted to gain an improved one, with the subject area of consideration well enough constrained and defined at any one point so that common sense may be focussed on the issue with only a minimum of extraneous disagreements.

The final point is crucial; if the application of relaxation methods to social field problems did not tend to reduce the frequency of disagreement concerning the essentially qualitative judgments to be made, there would be little advantage in the approach as an analytic tool.* Fortunately, there are some significant kinds of problems in which experience has shown that such alternation between the particular and the whole does reduce sharply such disagreement, lending credence to the idea that the results may be relatively valid. At least, they have better claim to validity than ones arrived at by assuming that the pattern of the whole has little to do with component relations--"I'll solve one piece

* Although there still would appear to be good reason to use such methods in teaching and learning.

at a time, and complexity be damned," or the converse sort of foolishness that disregards the parts ("This is the way it is, so stop bothering me with factual trivia.")

The present FAR method differs from most engineering relaxation methods in several ways. Most importantly, the detection and relief of anomalies is performed in a regular way in FAR only as differences emerge between results for the same step of analysis at successive cycles through the several steps. For example, a major opportunity for such detection and correction is offered when Step 2 is undertaken for the second time; at that point, two answers to the same general question have been produced, and comparison between them offers a measure of the extent to which the movement around the cycle has improved one's comprehension of the field and an opportunity to perform interior adjustments calculated to help bring the gestalt futures and the constructs used in developing them into confluence. A much closer correspondence with engineering methods would be offered if a cycle treatment could be designed to permit iterative attention to conditions projected to exist at a specified time along a specified whole-body future, with refined adjustments being made so that the factors composing an apparently self-consistent configuration might fit together even better.

Such adaptation of one factor to fit the situation, followed by readjustment of others to compensate for the initial correction, would make FAR an almost exact extension into qualitative modes of analysis of existing engineering relaxation methods. It is done currently in FAR on largely intuitive grounds and without any orderly account being taken of secondary disturbances due to corrections. It was thought a year ago that it would prove relatively simple to order the processes involved, but it has not proved to be easy. If it were to be achieved, however, a positive advantage would be gained, since we all would have available

to us a much better process for analizing social equilibria. Currently, the key probably lies in careful Lewinian mapping of the factor fields within sectors and probably of the interior grain of the factors.

Perturbation Projection

One of the most frustrating aspects of the present situation is that the FAR method helps us materially to lay out and internally review a set of alternative patterns to serve as contexts for decision, but it offers no methodical approach to the key executive question, "What would be the probable consequences of this specified policy intervention within the context that you just described to me?" The arguments that point toward the need for alternative projections rather than for predictions seem to indicate that the question cannot be answered except within some heavily schematized model, at best a gross caricature of the actual situation and at worst bearing no functional resemblance to it. We believe that the prediction of the most probable future consequence of a policy intervention is no more possible than the prediction of the most probable future context itself. However, the planners' dilemma was eluded through the provision of bracketing sets of alternative futures, by being carefully not strict with ourselves, and a similar ploy seems likely to succeed here as well.

That is, while one cannot say just what might be the cause-and-effect chain of events flowing from a given action or set of them, even when an embracing context has been projected and is assumed for working purposes to be sound, it should be possible to adjust the FAR method to permit the projection of a spray of new projections, as variants on a primary one within which a policy disturbance is assumed. The question would not be the apparently unanswerable one suggested above but rather, "Given this whole-body projection--this "limb" on the futures "tree"--and this

hypothetical policy intervention, what might be a few of the more plausible lines of evolution that a planner should keep in mind as illustrative of the possible consequences of the intervention in question?"

Such an inquiry could be called perturbation projection. It would enhance the utility of present approaches in several ways, offering a sort of pseudo-casualty to serve in problem areas where some sense of consequence indeed is needed and in which ordinary cause-and-effect argument fails. Fails? Yes. To say that condition A will be changed into situation B because A is changed in specified ways, it is necessary to define both A and B in ways that make them logically fit and each of the simple looking symbols must represent the kind of overall complex of living patterns that are by the subject of the holistic projections under discussion in this entire report; such fields are broader than any form of logical, prosaic assertion, and there now seems no prospect of fitting them within that mode of discourse.

One should not be too hasty in offering to fit such problems into FAR, however. Such an extension or adaption of current methods of whole-body projection does seem likely to work, but to do so in any but the most course ways may prove impossible. It probably would call for deep inquiry into the fine grain of the factors disturbed by the policy intervention in the first place and those disturbed subsequently as homeostatic responses reverberate within the whole. In its final form, this problem may merge with the analysis of social equilibria that was discussed as the first possible extension of FAR. Nevertheless, this problem is enough like the one to which FAR already has proved to offer an effective approach so that there are grounds for hoping that it might be met to some extent without fundamental improvement of the existing method.

Teaching and Learning

The two potential extensions of the basic method that have been suggested would, if achieved, add materially to the roster of tools available for research support to policy formulation and even to the fundamentals of social science methodology, but searching for them might require considerable investment of effort with no guarantee of success. In contrast, those who have worked with FAR are almost unanimous in their conviction that its potentials in pedagogy are high and readily available. Research at EPRC already has flagged the teaching of comprehension of the complex wholes as being a fundamentally important issue, in this era when so few questions or answers are simple. FAR projection of alternative future conditions seem to require no basic intellectual equipment not possessed by most college students and many of those in high school; the experience of working through a projection of, say, the next decades' alternatives for the region in which a given school is located should teach participants in much the same way as CUSP projection has taught those of us involved in the activity. The teaching power of FAR is more convincing than its analytic utility.

The mere transmission of FAR results is an exercise in education. The results of the CUSP work and of other similar efforts to come will be made truly effective only when potential policy makers have learned them. The mere distribution of reports will not suffice, and briefings are only slightly more effective. The transfer of fundamentally artistic comprehensions from the researcher to those who might make use of his products is rarely done well and almost never reliably, but such rich "teaching" of results is needed.

Finally, the ultimate court of appeal is not the President but, in a democracy, the citizen. Education of juveniles may be (and is) an important hedge against the less attractive futures that have been

projected, but if any of the more favorable appearing futures are to mature, it seems probable that adult education should attend urgently and at once to teaching present citizens a sense of the future. Comprehension of future alternatives should help all citizens to deal concurrently with uncertainty and responsibility, neither abandoning the latter nor denying the former. The use of FAR to help teach adults at large what it uncovers in the way of future alternatives seems almost sure to work, if appropriate simplifications are made, and it should help especially in making uncertainty seem both real and tolerable. If truly efficient means of "injecting" gestalt research results into executives can be invented, those same means might enhance public comprehension, swiftly enough to avert disaster.