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The Next Thirty Years

Concepts and Anticipations[1]

Prediction and Planning

We are here concerned with identifying the needs which the social sciences should be prepared to meet in the next 30 years.

There is a common feeling that men's needs for understanding and controlling themselves and their societies may, in the next 30 years, be different from their current needs. It is difficult to deny the validity of these feelings. Practically all of our social institutions, the regulative as well as the productive ones, have been evolving in this century at a rate which promises substantial change in the next 30 years. Certainly a significant degree of change is to be expected in the ways men can relate themselves to others.

This is a challenge to the social sciences. Their capabilities are in understandings, scientists, methods and, not least, institutionalized arrangements for teaching, research and relating the social sciences to the society. None of these capabilities can be quickly grown, run down, redirected or coalesced. Together with the intense competition with other sciences, professions, etc., for rare resources, the social sciences have their own theoretical blinkers, vested professional interests and institutional rigidities. Apart from the fads and fashions with which we are still afflicted, our recent history suggests that we cannot expect an important new insight seriously to affect the growth or direction of the social sciences in under five years. (For major projects like those of *The*

Authoritarian Personality [Adorno et al., 1950] or Bruner's [1964] *Studies in Cognitive Growth*, five years is necessary from inception, through research and publication, to widespread impact on the research, teaching and applications of others.) Institutional growth and professional training almost certainly require us to think in terms of more than five years to get from inception to self-sustaining growth. However, this scale of from five to 10 years is not enough to effectively guide current decisions on investment.

Within the time scale of from five to 10 years, one could hope to plan for the development of important concrete capabilities, but the existence of capabilities (adequate theories, methods, personnel and organization) exerts a significant effect on what is expected of social science. The planners must consider, therefore, not just such questions as "Will these resources create this capability?" but also "How will the emergence of these capabilities transform the environment for which they are planned?" This consideration is neither fanciful nor trivial. We have ample historical evidence of how theoretical and institutional advances in the social sciences have, willynilly, attenuated or amplified the demand for other contemporaneous capabilities. It is hard to avoid the conclusion that each wave of planning must seek to create the conditions required for successfully planning the next wave, i.e., for a period of concrete investment one needs to have some image of the character of the next period and sufficient notions about the third period to sense what might be the goals of the second period. In the social sciences this would seem to involve a foresight of 20 to 30 years, but in no way to require a detailed forecast of this period. Decisions must be made with regard to current resources but there is no suggestion in this model of preempting later decisions--rather the opposite, to decide in such a way that later decision-makers are at least as well placed, as far as one can foresee, to make the choices they will wish to make.

It should be clear by now that, with planning, the social sciences can play an active role in the next decades, not simply a passive one--they can seek to modify directively their social environment in order to help men

better pursue the ends they desire and not be left to adapt passively to whatever blindly emerges. Insofar as the social sciences are concerned simply to adapt to the next 30 years, then planning for the future would be based on extrapolations of the sort that "by the 1990's *x* proportion of the population of size *X* will be in schools; given the past rate of increase in educational psychologists per 10,000 students, we must plan for a supply of ...." This sort of approach would leave unconsidered whether it might not, for instance, be better to develop a theory of pedagogy or a reorganization of industrial culture that would radically change the multiple effects of the educational psychologist or the preeminence of schools as places of learning. Paradoxically, the problems of making predictions would be easier if the social sciences stuck to a passive role. *By actively seeking to enhance man's ability to control himself and his institutions, the social sciences are more likely to contribute to genuine unpredictable novelty.* Men would have greater control, but the manner in which they would exercise it would be less obvious than if they continued as at present.

We have suggested that the approach to the next 30 years is very much influenced by whether one assumes for the social sciences an active role or a passive one. We have already argued that the concept of planning for a real world entails an active role; it is not reducible to predictions or forecasting (Drucker, 1957:52). Jerome Bruner (1964) in his presidential address to the Society for the Psychological Study of Social Issues made the essential point that the active role is not that of dictating:

> ...however able we are as psychologists, it is not our function to decide upon educational goals.... The psychologist is the scouting party of the political process where education is concerned. He can and must provide the full range of alternatives to challenge the society to choice." (pp.22-23)

Given the stress being laid on the distinction between active and passive

roles and the possibilities there are for misinterpretation, it is probably desirable to spell out the conceptual distinction.

The distinction we have been trying to make has been rigorously made by Sommerhoff (1950) in terms of "adaptation" and "directive correlation." Adaptation refers to the responses available for dealing with emergent environmental circumstances. The concept of directive correlation encompasses adaptation in that it allows for that system of causal relations in which the environment is actively influenced to determine the kinds of responses that will subsequently be adaptive.

The relation between these two concepts of adaptation and directive correlation can be stated precisely in diagrammatic form (Figure 1).

Both of these diagrams depict causal processes linking initial states at t_o with environmental conditions and (system) responses occurring together at a later time, t_1, and linking these to an end state or goal condition.

Both of these diagrams allow for variation in the range of initial conditions (of both the system and the environment); in the range of environmental conditions at t_1 for which there are corresponding responses; in the degree of matching of these, as reflected in the probability or precision of achieving the goal and, lastly, in the time scale represented by t_o, t_1 and t_2.
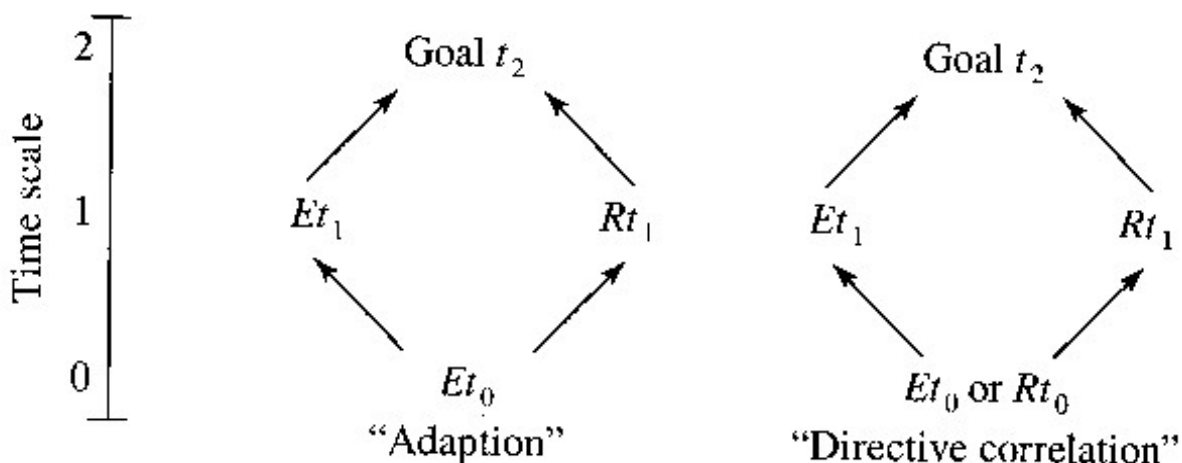
Figure 1. Comparison of adaptation and directive correlation.

They differ in one critical respect. The diagram defining adaptation is restricted to initial conditions of an environmental nature, i.e., it represents a stimulus-response relation. This, we hasten to add, is not a simple cause-effect relation. As Angyal (1941) phrases it, "...the stimulus prompts the response. The response is mainly determined by the intrinsic tendencies of the organism...[it] is essentially an autonomous function" (p.36) The stimulus for its part is, with respect to the organism, embedded in and predictive of heteronomous processes. An object or event in the environment has stimulus qualities only insofar as it is part of such a coupling of separate systems. This, however, represents only one form of directive correlation. The other is the form of coupling that occurs, for instance, when a man lights a fire. In this case, his wit and action set off an environmental process that enables him by appropriate responses to pursue goals of warmth, cooking, of visual contact, of security, of distillation, etc. Making fires is not only an adaptive response to the sun going down but can be a starting condition (a coenetic variable, from the Greek *coenos*--beginning) for a range of other purposive activities.

To be applied to the next 30 years of the social sciences, this

simple model of directive correlation would have to be elaborated because (a) the key environmental processes are people who are capable of directly correlating their activities with the social sciences, (b) in any real situation the social sciences will be involved in more than one other process and (c) the time scale involves a hierarchy of directive correlations within which the goals of the earlier ones are the starting conditions of the following. The second and third elaborations do not affect the basic properties of the simple model, namely, that *where a system can perceive and learn*, it is able to determine its future to a degree that is not possible for a system which relies on adapting.

However, the first elaboration clarifies Bruner's (1964) assertion (and our belief) that the active role of the social sciences in the coming decades is not reconcilable with the social sciences seeking to determine the future of man. Unlike the other sciences, *the social sciences cannot be indifferent to their subject matter*. They cannot, in fact, expect to survive, let alone grow, unless they pursue goals that are shared by their chosen objects of study. No matter how cunning or devious the social scientist became, it is almost certain that his subject matter would eventually outmanoeuvre him, as no physical particle could. This is not a new observation:

> "Suppose the physiognomist ever did have a man in his grasp, it would
> merely require a courageous resolution on the man's part to make himself
> again incomprehensible for centuries." (Lichtenberg, 1788, quoted by
> Hegel, 1949:345)

The survival and growth of social science presupposes a role in which it enhances the range and degree of directive correlations that men can form between themselves and their environment. Specifically, this might mean increasing the range of relevant conditions that men can take into account, increasing the range and efficiency of the responses they are able to make or

extending men's awareness of the goals they might successfully pursue. In each of these ways the social sciences can contribute to men's ability to choose and to make the next 30 years.

This contribution is only meaningful if, in fact, men have some ability and some desire to shape the future. We assume this to be the case, allowing only that (a) men can only proceed from the objective conditions of the present, (b) they tend to pursue only those goals that seem achievable (and hence may often be blind to possibilities that have newly emerged) and (c) the means they choose may frequently have unanticipated consequences for other goals.

In this section we have sought to argue that

- There is a need for developments in the social sciences that go beyond their present concerns.

- This development needs planning.

- The planning needs to be in a context of expected social developments for several decades ahead.

- The planning should be more than projection or forecasting.

- Planning should actively seek to extend the choices men can make, not to dictate them.

Some Futures

We argued in the first section of this paper that the future will be largely shaped by the choices men make, or fail to make, and that it will not be molded simply by technical forces; that processes existing in the present can reveal some of the basic choices that will confront men over the

next 30 years; and, finally, that social science should consider not only the provision of tools (trained personnel, institutions, theories and methods) but also the more active role of helping men to extend their visions.

On this basis we shall seek to identify current developments which are changing the conditions within which men can make their future, and we shall look at these both in terms of the challenges they pose and the opportunities they create for further human development. This should reveal the areas within which growth in social scientific knowledge and capabilities can most help men to help themselves.

We will move from consideration of the broader social systems to narrower ones. Following our own judgment, we will start from consideration of the total social field of entities such as the UK and the USA, i.e., modern Western nations. We are assuming that within *the inclusive system based on the world population* these constitute the leading part and will do so for several more decades. Our method of approach will be basically that proposed by Ashby (although he may not recognize it). Next, we will assume that the leading part in such systems is the technological system--the complex of interrelated socio-technical organizations concerned with the social (not household) production of material goods and services. We think that this method of proceeding is preferable to abstracting common phenotypical characteristic aspects such as political beliefs or values. The next step follows the same procedure of identifying information technology as the leading part of the technological system. Because this last step puts us at two removes from the total system, we then go back to see what effect this elaboration of the technological system has on the total system.

Lastly, we will touch upon the major boundary conditions of our primary unit. These appear to be

- the relation of the modern Western nations to the more inclusive international system;

- the biological inputs to the systems;

- the natural resources upon which they rely.

Throughout, our concern will be with matters on which the development of the social sciences might have a bearing.

Emerging Characteristics of the General Social Field

If there are predictions to be made they are most likely to be valid if they are derived from analysis of the broader systems. This is, of course, only a theoretical point; we may have little or no information on which to assess the larger systems. This is, in fact, the reason for our choosing the Western nations as a starting point although it is evident that they are part of a larger system. Nevertheless, we do not wish to be like the drunk in L.K. Frank's story who knew he had lost his watch up the dark alley but searched under the street lamp because there he had lots of light. There is a body of evidence accumulating about the growth characteristics of the Western type of society. This evidence is not of the sort that readily permits of graphical or mathematical extrapolation but it has seemed to us that it does permit of the Ashby type of analysis. We will devote most of our space to this analysis because it provides the framework within which more detailed predictions of part processes can be made. A simplified version of this analysis has been published, (Emery and Trist, 1965, Vol.III) but we are placing so much weight upon the conclusion that the argument should be spelt out more fully.

In trying to characterize large complex social systems, we are reminded that some behaviors of both organisms and organizations are a function of gross overall characteristics of the system of which they are parts and which constitutes their environment. We can advance our knowledge

of these behaviors if we can identify some of the ideal types that characterize the overall environment, as seen from the viewpoint of the generalized part/system relation.

This is not a new strategy for the social sciences. Thus, in psychology, the Lewinians were able to demonstrate the lawful behavior of "human beings in cognitively unstructured situations" (Barker et al., 1946). It is our belief that a great deal of so-called learning theory is of the same kind, e.g., behavior in "an overly simplified structured situation;" in a "complexly structured or problem situation;" in an "overly complex or puzzle situation." Similarly, Chein (1954) has pointed to the gain that may be had for psychology from the study of environments that, in overall terms, are relatively stimulating or stimulus lacking; relatively rich or poor in goals or noxiants, cues or goal paths; easy to move in or sticky, etc.

In the field of economic organization, a similar scientific strategy has yielded the characterization of markets as classical competitive; imperfectly competitive; oligopolic; monopolistic. These, again, are attempts to define ideal types of overall environments and, again, have been relatively successful in showing the lawfulness of some of the behavior of economic enterprises.

In the field of military organization, the great post-war disputes over optimum size of operating units, optimum weapon capabilities for size of unit, optimum organization of support facilities have all centered on the problem of the changes in the global characteristics of the battlefield environment because of the advent of tactical nuclear weapons.

The solution we seek is, therefore, along these lines. We have made very little progress, but this, we feel, reflects more upon our incompetence than on the correctness of the strategy. As a beginning we concentrated on that dimension of the environment which we would call its *causal texture* (Emery and Trist, Vol.III). By causal texture we mean, following Pepper (1934, 1942) the extent and manner in which the variables relevant to the constituent organizations (organisms) are, independently of

any particular part, causally related or interwoven with each other.

For simplicity of exposition we will consider the relevant variables only as goal objects or noxiants for the component parts and assume that there is some sense in which these can be spoken of as more or less distant from the organization and hence requiring more or less organizational effort to attain or avoid. Already, it will be noted, *something has to be known about the organization in order to delimit the environment in this way.* For our purposes, we have found it necessary to specify only four ideal types of organizational environments:[2]

1. The simplest is that in which goals and noxiants are relatively unchanging in themselves and randomly distributed within the environment. That is, a *placid, randomized environment.* This ideal corresponds closely enough to Simon's (1956) "surface over which it (an organism) can locomote. Most of the surface is perfectly bare, but at isolated, widely scattered points, there are little heaps of food." (p.130) It also corresponds with Ashby's (1960) limiting case of "no connection between the environmental parts" (Section 15/4); to Toda's (1962) "Taros Crater" (p.169); and Schutzenberger's (1954) random field (p.100). The economists' classical market probably comes close to this ideal environment. Thus, although this represents an extreme type of environment, there has been wide recognition of the need to postulate it as a theoretical limit. The relevance goes deeper than simply providing a theoretical benchmark. This low level of organization may frequently occur as the relevant environment for some secondary aspect of an organization and is also quite likely to occur in humanly designed environments for the reason that such simplified environments offer maximum probability of predicting and controlling human behavior, e.g., Adler's (1958) "Sociology of Concentration Camps" and the experimental environments of the animal learning theorists.

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[2]Any attempt to conceptualize a higher order of environmental complexity would probably involve us in notions similar to vortical processes. We have not pursued this because we cannot conceive of adaptation occurring in such fields.

The survival of an organization in a placid, randomized environment is a fairly simple function of the availability of these environmental relevancies, the approach-avoidance tactics available to the organism and how far it can move without "starving to death," i.e., reserves. (Simon, 1956:131) So long as the environment retains this random character, it does not make much difference if there is more than one need and it is not necessary to postulate any complex organizational capacity for identifying marginal utilities or substitution criteria. "We can go further, and assert that a primitive choice mechanism is adequate to take advantage of important economies, if they exist, which are derivable from the interdependence of the activities involved in satisfying the different needs." (p. 134)

A critical property that emerges from this has been stated very precisely by Schutzenberger (1954), namely that under this condition of random distribution there is no distinction between tactics and strategy--the "optimal strategy is just the simple tactic of attempting to do one's best on a purely local basis." (p.101) The best tactic can, in the circumstances, be learnt only on a trial and error basis and only for a particular class of local environmental variances. (Ashby, 1960:197) However, in these kinds of environments, information capacity can make an enormous difference to survival chances. Thus, Simon (1956), taking vision as the prototype tactic, finds that "a one-third increase in vision will have an even greater effect (than a like increase in reserves) reducing the range of starvation from one in 10^4 to one in 10^{40}. (p.133)

2.   More complicated, but still essentially a placid environment, is that which can be adequately characterized in terms of *clustering*, i.e., the kind of static environment in which the goals and noxiants are not randomly distributed but hang together in certain lawful ways. This is really the case with which Tolman and Brunswik (1935) were basically concerned and corresponds closely to Ashby's serial system. The structuring that exists within the environment enables some parts of it to act as signs (local representatives) of other parts or as means-objects (manipulanda, paths) with respect to

approaching or avoiding. However, as Ashby (1960) has shown, survival is
almost impossible if an organization attempts to deal tactically with each
environmental variance as it occurs or is signalled (signalling having the
effect of multiplying greatly the density of confrontation. (p. 199) Much
the same point is made by Simon (1956) and by Tomkins (1962). Along with
Ashby, they postulate that survival in environments of this kind requires a
second order of feedback involving some sort of threshold mechanism so that
reaction is evoked less readily and only to the more general aspects of the
environment--to the clustering which will reveal itself only through a
manifold of particular occurrences.

 We feel that this is the critical feature of this kind of
environment, namely that choice of organizational strategies emerges as
distinctively more adaptive than choice of tactics. (It is this which is the
"ultrastability" of which Ashby writes.) It no longer follows that "a bird in
the hand is worth two in the bush." The survival of a system in this kind of
environment is conditional upon its knowledge of its environment. To pursue
the goal that it can see, the goal with which it is immediately confronted,
may lead the system into parts of the field which are fraught with
difficulties. Similarly, avoiding a present difficulty may lead a system away
from parts of the environment that are potentially rewarding.

 In this sort of environment it becomes possible to seek a best
strategy where optimality is limited only by restrictions upon knowledge. In
the extreme case, enough is known of the structure of the environment so that
"the map's projection has been changed to that of the really optimal matrix,
the distinction between strategy and tactic (again) disappears
(Schutzenberger, 1954:100)." This differs from the randomized environment in
that here strategy tends to absorb tactics. Given the omnipotence of a
Laplace, then the tactics would be derivable from the strategy. A knowledge
of optimal strategies will not, of course, emerge full-blown. These
environments will be best learned if an organization proceeds in a piecemeal
but sequential fashion by tackling more and more inclusive goals while always

keeping the totality of novel features within an optimal limit of
meaningfulness.

The objective of an organization in this sort of environment also
has certain characteristics. In the first case it could have none, apart from
tactical improvement and hoarding against a rainy day. In this case the
relevant objective is that of "optimal location." Given that the environment
is non-randomly arranged, some positions can be discerned as potentially
richer than others and the survival probability will be critically dependent
upon getting to those positions. So much of management of organizations is
concerned with planning that it is worth considering some of the
approximations that are appropriate in this type of environment:

- The recognition of clustering itself so that, at the level of
  strategic planning, one is concerned with relatively few clusters,
  which can be approximately characterized as units, instead of with
  a multitude of individual objects. This lowers the cost of
  information gathering and processing.

- The development of a hierarchy of strategies as in the rules for
  trouble-shooting in complex equipment.

- The assignment of step functions to the values of goals and
  noxiants instead of trying to act on a continuous range of values.

- The backward determination of the strategic path. This is by far
  the least demanding procedure once the strategic objective is
  selected. This, however, does require subsequent adjustments of
  the strategic objective to fit the available paths.

These methods of developing strategies may not bear much similarity to formal
models of rational decision-making but they come close to describing the

decision-making we have been privileged to observe.

3.   The next ideal level of causal texturing is one that we have
called the *disturbed, reactive environment*. It approximates the economists'
oligopolic market. In this we simply postulate a Type II environment in which
there is more than one system of the same kind or, to put it another way,
where there is more than one system and the environment that is relevant to
the survival of one is relevant to the survival of the other. Formally, one
could postulate a Type I random environment with more than one system present,
but we do not think that co-presence makes any difference to the concepts one
needs to explain what differences would actually occur in the particular
environment (which might be why social psychology has at present such
difficulties in linking up with so-called "learning theory"). Co-presence
makes a real difference in a Type II environment because the survival of the
individual systems requires some strategy as well as tactics.

In the Type II environment, each system does not simply have to
take account of the other when they meet at random, but it has to consider
that what it knows about the environment can be known by another. That part
of the environment to which it wishes to move is probably, for the same
reason, the part to which the other wants to move. Knowing this, they will
wish to improve their own chances by hindering the other, and they will know
that the other will not only wish to do likewise, but will know that they know
this. In a word, the presence of others will imbricate some of the causal
strands in the environment. The causal texture of the environment will,
through the reactions of others, be partly determined by the intentions of the
acting organization. However, the environment at large still provides a
relatively stable ground for the arenas of organizational conflict. Because
of this, conflicting organizations "regarded as a unit will form a whole which
is ultrastable" (Ashby, 1960:209).

How can competing organizations constitute a stable unit in a Type
III environment? Given the relatively static nature of the environment within
which the competition occurs, it is possible (as it was for the individual

organization in a Type II environment) for strategies to evolve that limit the disruptive effects of competitive strategies or competitive tactics. One would expect these strategies to be broader and take longer to emerge than those needed in a Type II environment. They would not, however, differ in principle.

It will be noted that by starting from consideration of the causal texture of the environment and the way information flows from this, we avoid the dilemma of the economists' models of imperfect competition, duopoly, etc. As Ferguson and Pfoutts (1962) point out, the models yield predictions of inherent instability despite the observable fact that stability is commonly achieved. Ferguson and Pfoutts do, however, show that stability can be deduced if one postulates information flow and learning. By taking into account environmental properties, we find, as Simon found with the simplest environment, that we have less need to inject into our organizational models (or models of man) a host of ad hoc special mechanisms, and we are less likely to arrive at false conclusions.

One could maintain that this sort of *disturbed-reactive environment* makes no difference to the distinction between strategy and tactics that we made for Type II environments. We are inclined to think that it does. If strategy is essentially a matter of selecting the "strategic objective"--where one wishes to be at a future time--and tactics a matter of selecting an immediate action from one's available repertoire, then there appears in these environments to be an intermediate level. One has not simply to make sequential choices of actions (tactical decisions) such that each handles the immediate situation and yet they hang together by each bringing one closer to the strategic objective; instead one has to choose actions that will draw off the other organizations in order that one may proceed. The new element is that of choosing not only your own best tactic, but also of choosing which of someone else's tactics you wish to take place. Movement towards a strategic objective in these environments therefore seems to

necessitate choice at an intermediate level--choice of an operation[3] of campaign in which are involved a planned series of tactical initiatives and calculated reactions by others and counter-action.

There seems little doubt that even the formulation of strategic objectives is influenced by this kind of environment. It is much less appropriate to define the objective in terms of location in some relatively static and persisting environment. It is much more necessary to define the objective in terms of developing the capacity or power needed to be able to move more or less at will, e.g., to define business objectives in terms of profitability, not profit. This latter kind of formulation has one advantage in this kind of environment, in that there can be a day-to-day feedback of information relevant to this objective. In the former case, the day-to-day feedback about approach to a given location (e.g., percentage of market) may be extremely misleading. It may conceal the fact that the competitor has made it easy by conserving his strength for a later stage (e.g., preparing to introduce an improved product).

The factors in this kind of environment that make it desirable to formulate strategic objectives in power terms also give particular relevance to strategies of absorption and parasitism. It is one thing in a Type I environment if other systems can be characterized as goals or noxiants--they are either absorbed for the temporary sustenance they afford, or else avoided because noxious. It is another thing in a Type III environment when the other has to be absorbed or be absorbed into because it is potentially noxious-- because it is a source of important but uncontrolled variance.

4.   The most complexly textured environments that we have had cause to postulate are what we have called *turbulent fields*. These are environments in which there are dynamic processes arising from the field itself which create significant variances for the component systems. Like Type III and unlike Types I and II, they (Type IV) are dynamic environments. Unlike Type III, we

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[3]cf. the use by German and Soviet military theorists of the three levels--tactics, operations, strategy.

are postulating dynamic properties that arise not simply from the interaction of the systems but also from the field itself.

There are undoubtedly important instances in which these dynamic field properties arise quite independently of the systems in the field (as with some of the earth and water movements in mining). However, in the conceptual series we are here elaborating, most significance attaches to the case where the dynamic field processes emerge as an unplanned consequence of the actions of the component systems; that is, those environments that represent a transformation of Type III environments. Fairly simple examples of this may be seen in fishing and lumbering where competitive strategies, based on an assumption that the environment is static, may, by over-fishing and over-cutting, set off disastrous dynamic processes in the fish and plant populations. We have recently become more aware of these processes through the intervention of the ecologists in problems of environmental pollution. It is not difficult to see that even more complex dynamic processes may be triggered off in human populations.

There are four trends that we feel have particularly contributed to the emergence of these Type IV environments. Before stating these, however, let us briefly state that *these fields are so complex, so richly joined, that it is difficult to see how individual organizations can, by their own efforts, successfully adapt to them.* Strategic planning and collusion can no more ensure stability in these turbulent fields than can tactics in the Type II and III environments. If there are solutions, they lie elsewhere.

The four trends that we feel have together contributed most to the emergence of dynamic field forces are:

1.   The growth to meet Type III conditions of organizations and linked sets of organizations that are so large that their actions are persistent enough and strong enough to induce autochthonous processes (Rothermel, 1982) in the environment (we are here postulating an effect similar to that of a company of soldiers marching in step over a

bridge.)

2.   The deepening interdependence between the economic and the other facets of the society. The growing size and relative importance of the individual units not only creates the interdependence within their economic environment; it also produces interdependence between what consumers want and what they think can be produced, between the citizen as consumer, as producer and as a social and political entity. This greater interdependence, when matched with the independent increase in the power of other citizen roles, means that economic organizations are increasingly enmeshed in legislation and public regulation of what they do or might think of doing. The consequences that flow from the actions of organizations lead off in ways that are unpredictable. In particular, the emergence of active field forces (forces other than those stemming from the individual organization or the similar organizations competing with it) means that the effects will not tend to fall off "with the square of the distance from the sources" but may at any point be amplified beyond all expectation. As a simple case in point, the Dutch addition of an anti-spattering chemical to margarine created a major crisis in the national margarine market. Similarly, lines of action that are strongly pursued may find themselves unexpectedly attenuated by emergent field forces that, for instance, cast a social stigma on certain kind of advertising. For the organization, *these changes mean primarily a gross increase in their area of relevant uncertainty.*

3.   The increasing reliance upon scientific research and development to achieve the capacity to meet competitive challenge (which capacity, we suggested, tends to become the strategic objective in Type III environments). This has the effect not only of increasing the rate of change, but of deepening the interdependence between organizations and

their environment. Choices that once appeared to arise from the market place are now seen as being taken by the organization on behalf of the customer--they are seen as manipulators of desire. It is not hard to imagine an organization finishing up in the dock of public opinion because it chose a line of technical development that appeared to suit its own needs but eventually left the economy in the lurch. The same trend appears in fields of public policy-making where competition over the allocation of resources is increasingly conducted by means of scientific research and analysis.

4.   The radical increase in the speed, scope and capacity of intra-species communication. Telegraph, telephone, radio, radar, television, gramophone, typewriter, linotype, camera, duplicator, Xerox, calculator, Hollerith, computer--these names register a century of change that continues in an explosive fashion. Parallel with these has been a very great increase in speed and ease of travel so that recorded communications flow in greater bulk at greater speed, and even the recording of communications becomes short circuited as it becomes easier for managers, scientists, politicians, etc. to fly to be together than to correspond. We may recall that Trotter (1919) in searching for the conditions underlying social reactivity in living populations, postulated only two critical conditions: some special sensitivity to their own kind and some intra-species communication system. The change that has taken place in the second condition is a greater mutation than if man had grown a second head. The consequences are a great increase in the information burden and a radical reduction in response time in the system--a reduction which is unaffected by distance. Reaction takes place almost before action is formed. Servo systems with these properties can readily get entangled in erratic "hunting" behaviors.

We will probably find that these trends are only a part of the

picture and perhaps not even the significant part. However, they are in themselves real enough and may explain why we feel that consideration of the turbulent fields is a matter of central importance and not just a theoretical exercise.

What is less clear is how our society can adapt to these conditions. Ashby (1960) very wisely counsels that there may not be a solution to this problem:

> As the system is made larger (and is richly joined), so does the time of adaptation tend to increase beyond all bounds of what is practical; in other words, the ultrastable system probably fails. But this failure does not discredit the ultrastable system, as a model of the brain for such an environment is one that is also likely to defeat the living brain. (p. 207)

However, as a biologist, Ashby offers us the consolation that "examples of environments that are both rich, large and richly connected are not common, for our terrestrial environment is widely characterized by being highly sub-divided." (p. 205) It is our firm belief that this sort of environment is, in fact, characteristic of the human condition. What is true is that just as the central matching process of consciousness has evolved to help protect the human organisms from information overload, so has man evolved his symbolic cultures to provide a man-made environment of tolerable complexity. What is significant of our present era is the emergence of a degree of social organizational complexity and a rate of coalescence of previously segregated populations that defy our current efforts at symbolic reductionism.

Adaptation to Turbulent Environments

If our analysis is correct, then the next 30 years (at least) will evolve around men's attempts to create social forms and ways of life that are

adaptive to turbulent environments or which downgrade them to the less complex types of environments. As we argued earlier, survival questions are basic ones and insofar as our societies can take on Type IV properties, survival of our current institutional forms is challenged and men will inevitably turn to these questions. We can and will try to spell out some of the ways in which survival can be sought. We cannot predict which paths men will actually take or the actual means they will evolve in order to travel along the paths they choose. What we do know is that the social sciences could influence this process insofar as they give men greater insight into what they want and provide an extended range of means whereby they can pursue desired ends.

Our statement of the problem (and the above quote from Ashby) gives one a clue as to the way men might try to solve it. If the environment is over-complex then downgrade complexity by segmentation, fractionation or dissociation. These are the three general ways in which this can be done. It should be borne in mind that these are just the three possibilities open to *passive adaptation*. They are essentially defense mechanisms. After we have discussed them, we will raise the question of whether it is open to men more actively to transform their environment by changing the conditions leading to complexity.

First, one may restrict the range of conditions to which one may respond (i.e., the range of coenetic variables). The classic mode of restriction has been that of repression or, in a society, the limitation of access or like forms of suppression or oppression. This does not seem to be the current mode. Any and every possible source of human and social needs and behavior are publicly explored. The dominant mode at present seems to involve some form of trivialization--if anything might lead to anything, then one is free to choose what one responds to. The dynamics have been clearly spelt out in Thorndike's puzzle box experiment.

When a situation becomes too complex for organized meaningful learning, an organism regresses to *vicarious* trial and error behavior--it responds first to this and then to that in a way which is unrelated to the

structure of the environment but may be highly correlated with its own prejudices. Where this becomes a prevalent mode of adaptation, one may still get highly intelligent behavior in the sense that an intelligence test measures the range and efficiency of responses to a strictly defined and limited set of coenetic variables. Creativity will tend to be absent because this is essentially the sensing that a situation involves a different set of coenetic variables to those that are usually assumed. The most significant manifestation is *superficiality*.

When responses are no longer critically and selectively related to hypotheses about the coenetic variables, they no longer manifest such hypotheses and no longer challenge alternative hypotheses. It is the prevalence of this, as he sees, it that leads Marcuse (1956) to characterize "advanced industrial society" as *one dimensional society* and its typical citizen as *one dimensional man*. Like us, he starts from the point that "the range of choice open to the individual is not the decisive factor in determining the degree of human freedom, but *what* can be chosen and what *is* chosen by the individual." The latter is not restricted by suppression or repression but "the distinguishing feature of advanced industrial society is its effective *suffocation* of those needs which demand liberation." (p.7, our emphases) In case he should be misread to imply that he is referring to the more trivial consequences of the mass media presenting an over complexity of choice, Marcuse emphasizes that

> The pre-conditioning does not start with the mass production of radio and television and with the centralization of their control. The people enter this stage as pre-conditioned receptacles of long standing; *the decisive difference is in the flattening out of the contrast (or conflict) between the given and the possible, between the satisfied and the unsatisfied needs*. (p.8, our emphases)

This is what we mean when speaking of increased superficiality--of increased

indifference to what needs or demands are taken as the starting point for
one's behavioral responses. This is not only an individual response to over-
complexity. An organization can diversify its "product lines" so that it can
become relatively indifferent to the fate of any particular one. In a society
it encourages "fractionation." Members are thrust aside or move aside, not
because they constitute a viable social sub-system with goals in conflict with
the larger system, but because, as individuals, they are nonconforming. They
refuse to be indifferent to the roots of their individual behavior and are
outcast as alcoholics, perverts, beatniks or eggheads. Insofar as these
people are an identified source of social variance, their exclusion seems to
reduce the total amount of relevant variance in the environment.

Marcuse goes beyond us in one very significant respect. We argued
only that, given a turbulent Type IV environment, this was one of three ways
of adapting to it. He argues that this mode of adaptation has become so
deeply rooted, at least in the USA, that that society can be characterized as
a "one dimensional society" and, further, that means that "'liberation of
inherent possibilities' no longer adequately expresses the historical
alternatives" (p.255) or, in his final sentence, the quote from Benjamin: "It
is only for the sake of those without hope that hope is given to us." (p.257)

Marcuse might be right about the present but we will stay with our
earlier theoretical position and maintain that, while at this level one can
spell out the alternative future paths, it is necessary to go on to
consideration of the leading part if one wishes to see what paths are likely
to be taken. His judgment is, of course, very relevant even if it only
specifies one of the present conditions from which men in the advanced
industrial societies choose their futures. On this particular point, we have
the reinforcing evidence advanced by Angyal (1965). Experience in clinical
practice up to his death in 1960 led him to observe that while

...the dimension of vicarious living (hysteria) can be safely
described as the "neurosis of our time".... Recently, however,

the compliant (conforming) pattern emphasized by Fromm, Riesman
and others began to give way to the secondary type, the hysteria
with negativistic defenses. The "rebellious hysteric" is already
quite prominent both in therapists' offices and on the social
scene. It is possible that he will become the dominant
sociological type, the spokesman of the times. (p.154, our
inserts)

He sees the phenomena as being, at the social level of the beatnik, "a protest
against the levelling tendency of social conformation which threatens the
extinction of spontaneous individuality." (p.154)

From our point of view, this changing pattern of common neuroses
suggests that the neurotics may, like artists, be reacting to emerging trends
before their more stable fellows. Their basic sense of personal worthlessness
may make them more dependent upon the fabric of cultural symbols and hence
more sensitive to flaws and rents that are beginning to emerge. What is
today's preoccupation with T-grouping and teamwork was the neurosis of
yesterday. What is today's neurotic striving for individuality may well be
tomorrow's goal (or confusion). If this is so then, despite the impression
that Marcuse and Angyal have of the dominance of superficiality, the forces
toward other choices may already be operative in the advanced industrial
societies.

The second way of simplifying an over-complex environment is that
of *fragmentation* or, more literally, disintegration. As a social system
differentiates to better cope with complexity, it also increases the
possibility of parts pursuing their ends without respect to the total system.
This may not be as big a threat to the survival of the part as it first seems.
Given a multiplicity of specialized parts, there may be many different
assemblies of parts that can serve the system goals (crudely, troops can load
ships if the dockers strike, or an airlift can be laid on). Thus, temporary
non-functioning of a part need not lead to its permanent destruction or

replacement. For the part itself, the path of segregation involves the risk of major errors but these may seem no worse than risking the devil of over-complexity. To our knowledge, no observer has previously contended that this defensive response is the model response. There is, at the same time, uneasiness amongst the social observers that the recent rapid advance in industrial societies has been leaving behind largish fragments of their own societies (notably the poor), intensifying the pressures to disintegrate into smaller, more culturally homogeneous entities (whether Negro, Welsh, Breton, the urban poor or the rural communities) and widening the gulf between the cultures of advanced and under-developed countries. As a response to over-complexity this is adaptive, provided and insofar as there emerge other system relations which, while less binding, enable the enhanced self-control of the part to be guided by a knowledge of the state, capacities and goals of the total system. Such system relations are emerging in national planning, etc. and, although they may be a step behind the tendencies to fragmentation, there is no convincing evidence that this is other than temporary. While we certainly see no evidence for the emergence of super-states as larger versions of nation states, we do not think the evidence for fragmentation is sufficient to prove this is a goal in itself, or will become one in the next few decades.

The third defensive possibility is *dissociation*--a degrading in what Angyal (1965) terms the "transverse dimension of system organization" and what we prefer to term the properties of coordination and regulation. Essentially, dissociation would entail that the possible outcomes of the behaviors of others are less frequently taken into account as a starting condition for one's own behavior, or that there is positive restriction on which outcomes would be considered. This is particularly likely when, as with a scratch team of football players, there is no common perception of the situations that emerge or, with a batch of new prisoners, a definite disinclination to associate. There is no real contradiction between this mode of adaptation to over-complexity and that of superficiality. If anything, it acts to restrict the area within which even superficial conformity will be

sought and hence, in that way, heighten the tendencies of segmentation.

This mutual enhancement of the defensive adaptations is not surprising. All three of these are ways of personal or organizational disengagement. They may be taken in parallel or sequentially. It is quite possible that there are cultural differences. Certainly, the British society seems to have been remarkably more tolerant--less given to segmentative tactics--than, for instance, the USA or Australia. On the other hand, the British seem more likely to dissociate on the grounds of "I don't want to know," while the Americans and Australians defend their superficiality with "so what?" or "I couldn't care less." Neumann (1954) sees dissociation as being at least as important a technique in modern society as superficiality. He points to the loss in power and intensity of the cultural canons (e.g., "God" and "conscience") which once defined a common world for joint action. The trends in criminal statistics certainly suggest that there are forces in the society that warrant taking this path.

Reviewing our notes on these three mechanisms, we can conclude that:

- They are mutually facilitating defenses, not mutually exclusive.

- They all tend to fragment the spatial and temporal connectedness of the larger social systems and focus further adaptive efforts on the localized here-and-now.

- They all tend to sap the energies that are available to, and can be mobilized by, the larger systems and otherwise reduce their adaptiveness.

Despite the strong cases that have been argued for superficiality (fractionation) and dissociation as major characteristics of the present, and despite the current concern with racial segmentation, poverty and the under-

developed nations, we do not think these necessarily define man's future.
They are so important that any society should collect statistics on these
processes as avidly as they collect meteorological data. However, none of the
modern industrial nations is so obviously undermined by these processes that
it lacks the power to adapt in other ways.

Possibilities for Transforming the Social Environment

Men are not limited simply to adapting to the environment as
given. Insofar as they understand the laws governing their environment, they
can modify the conditions producing their subsequent environments and hence
radically change the definition of "an adaptive response."

We suggest that such possibilities are present in the turbulent
Type IV environments. There are some indications of a solution which might
even have the same general significance for these turbulent environments as
the emergence of strategy (or ultra-stable systems) has for Types II and III.
Briefly, this is the emergence of values which have an over-riding
significance for all members of the field. *Values have always emerged as a
human response to persisting areas of relevant uncertainty.* Because we have
not been able to trace out the possible consequences of our actions as they
are amplified and resonated through our extended social fields, we have sought
to agree upon rules, such as the Ten Commandments, that will provide each of
us with a guide and a ready calculus. Because we have been continually
confronted with conflicting possibilities for goal pursuit, we have tended to
identify hierarchies of valued ends. Typically these are not goals or even
the more important goals. They are ideals like "health and happiness" that at
best one can approach stochastically. Less obviously values, but essentially
of the same nature, are the axioms and symbols that lead us to be especially
responsive to certain kinds of starting conditions. Prejudice is a clear
example of this kind of valuation; pride in conscious logicality or in

personal autonomy are cases where the evaluation concerns starting conditions within oneself.

It is essential to bear in mind that values are not strategies or tactics and cannot be reduced to them. As Lewin (Lewin et al., 1944:14) has pointed out, they have the conceptual character of "power fields" and act as guides to behavior.

Insofar as values do emerge, the character of those richly joined turbulent fields changes in a most striking fashion. For large classes of events their relevance no longer has to be sought in an intricate mesh of diverging causal strands, but is given directly, and in almost binary form, by references to the ethical code. So clear and direct is this form of reference that men have typically failed to distinguish between the value and its various physical and social symbolizations (Goldschmidt, 1959:76). By this transformation there is created a field which is no longer richly joined and turbulent but is simplified and relatively static. Men and their organizations can expect to adapt successfully to this type of field.

In suggesting that values offer a way of coping with our emerging turbulent environment, we have only opened up the problem, but at least it directs attention to a set of subordinate questions. The most difficult of these questions is "what values?" Somewhat less difficult are the other questions--"how do these values enter into and shape the life of the individual?" and "how do these values enter into and shape the organizational structures that men create?"

The difficulty with the first question is quite simply that we have done so little to establish a "science of morality." What we do know about values is that they take a tremendously long time to emerge. The salience of a particular value may change rapidly for a community or an individual, but a new value can be distilled only from generations of experience. This unselfconscious process of value formation is too slow to meet present pressing requirements. It seems necessary for social scientists to exert their efforts to speed up the distillation process, although at the

moment the most concrete proposals we have for identifying ideal goals are those of Churchman and Ackoff (1949). Short of this, something can be done by searching amongst existing values for some that may be appropriate. This can only be an ad hoc solution fraught with danger. If it is necessary to beat a partial retreat from the overwhelming uncertainties of a turbulent field, it is nevertheless crucial that the substitute symbolical field represent in its key symbols--the values--the main causal strands of the real world. The existing values may not convey enough of the new realities and we still have to develop methods of analysis that will identify the referents of values.

On general grounds we may well query whether existing values provide an adequate pool from which to select. The processes of social evaluation have too frequently proceeded from an initial simplifying dichotomy of God or the Devil. This sort of distinction usefully goes beyond the notion of good or evil because it allows that what seems to be good is evil and vice versa. The simplification to *external* competing influences has, however, meant little development of values as guides in the areas where organized social life and group life are both critically involved--in the areas that we tend to label as charismatic, mob behavior, fads and fashions or otherwise as irrational group behavior. These sorts of blind ground movements would seem to be more salient in the turbulent fields.

If the questions we have posed about values each had to have its own separate solution, we might well doubt whether men could cope with them in the next generation and then find ourselves writing some very pessimistic scenarios for the 1990s. In our view this is not the case--the three problems seem to be soluble by a single strategy.

This strategy is based on the notion that it is in the design of their social organization that men can make the biggest impact upon those environmental forces that mold their values (that make some ends more attractive, some assumptions about oneself and one's world more viable); further, it assumes that if these changes are made in the leading part--the socio-technical organizations--the effects will be more likely to spread more

quickly than if made elsewhere. We realize this is contrary to the Billy Graham strategy of going straight to the hearts of men and that it is contrary to Jesuitical-psychoanalytical notions of going to the cradle or the school. *We are suggesting that adults be the educators and that they educate themselves in the process of realizing their chosen organizational designs.* This confronts us with the question of what might be the most appropriate values, and we are suggesting that the first decisions about values for the future control of our turbulent environments are the decisions that go into choosing our basic organizational designs. If we can spell out the possible choices in design we can see what alternative values are involved and perhaps hazard a guess at which values will be pursued by Western societies.

As this spelling out has to be stretched out and may be a bit tedious, we will state our conclusions first. We find that choices in basic organizational design are inevitable so there is no question but that men will make them (even if they are not conscious of doing so); the choice is really between whether a population seeks to enhance its chances of survival by strengthening and elaborating special social mechanisms of control or by increasing the adaptiveness of its individual members; the latter is a feasible strategy in a turbulent environment and one to which Western societies seem culturally biased.

We have stated that choice is unavoidable. What makes it unavoidable is what we might clumsily call a *design principle*. In designing an adaptive self-regulating system, one has to have built-in redundancy or else settle for a system with a fixed repertoire of responses that are adaptive only to a finite, strictly identified set of environmental conditions. This is an important property of any system, as an arithmetical increase in redundancy tends to produce a log-increase in reliability. The redundancy may be achieved by having redundant parts but then there must be a special control mechanism (specialized parts) that determine which parts are active or redundant for any particular adaptive response. If the control is to be reliable it must also have redundant parts and the question of a further

control emerges. In this type of system, reliability is bought at the cost of providing and maintaining the redundant parts, hence the tendency is toward continual reduction of the functions--and hence cost--of the individual part. The social system of an ant colony relies more upon this principle than does a human system, and a computer more than does an ant colony. The alternative principle is to increase the redundancy of functions of the individual parts. This does not entail a pressure toward higher and higher orders of special control mechanisms, but it does entail effective mechanisms within the part for setting and re-setting its functions--for human beings, shared values are the most significant of these self-regulating devices. Installing these values, of course, increases the cost of the parts. The human body is the classic example of this type of system and it is becoming more certain that the brain operates by means of overlapping assemblies based on similar sharing of parts.

Whatever wisdom one attributes to biological evolution, the fact is that in the design of social organizations, we have a genuine choice between these design principles. When the cost of the parts (in our context, the cost of individual life) is low, the principle of redundant parts is attractive. The modern Western societies are currently raising their notion of the value of individual life, but a change in reproductive rates and investment rates could reverse this. There is, however, a more general principle that favors the Western ideal. The total error in a system can be represented as equal to the square root of the sum of the squares of all the component errors. It follows that a reduction in the error of *all* the components produces a greater increase in reliability than does an equal amount of reduction that is confined to some of them (e.g., to the special control parts). We are certainly not suggesting that this principle has been, or is even now, a conscious part of Western ideologies. Some sense of it does, however, seem to have reinforced our prejudice toward democratic forms of organization.

Two further factors operate in the same direction. When the

sources of error are not independent, i.e., they are correlated, then the tactic of overall reduction in error is even more advantageous. In human systems, communication is a potent factor and hence the advantages are considerable. When, in fact, the alternative design principle of redundant parts is adopted there are strong reasons for reducing the correlation of parts, e.g., anti-unionism or the management of concentration camps (Adler, 1958). The second factor also happens to be a basic concern--environmental complexity. The second design principle allows for a much greater range of adaptive responses than does a redundancy of parts--although its tolerance for error in any particular response is less.

Whatever the advantage to the individual of organizational designs based upon redundancy of functions, and despite the sum of the advantages we have mentioned, it is by no means certain that this gives survival advantages to the total international system. Whether it does or not we will be better able to judge by the end of the next 30 years when, with the industrialization of Asia, there will have been a more equal test of the alternatives. In any case, it seems much more likely that the Western societies will seek solutions in this direction, to the point of non-survival, than that they will evolve to some sort of Orwellian 1984. A judgment of this kind does presuppose what we have not yet discussed--the character and likely development of the leading parts of the system.

Certain current developments in the area of technology/production give us reason to hope that effective "democratic" solutions will be found before the passive adaptive modes force us toward "totalitarian" solutions. These are the rapid emergence of, in the US, what has been termed "systems management," and the programs being pursued in the UK and Norway by trade union leaders and management to develop (with social scientists) effective ways of involving individuals in the control of their working organizations. Systems management is a radical change from our traditional patterns of organization and much wider in its concerns and application than the much advertised cost-effectiveness studies of weapon systems. Its characteristics

clearly relate it to the general problem of environmental transformation that we have been describing:

- A more open and deliberate attention to the selection of ends toward which planned action is directed and an effort to improve planning by sharpening the definition of ends.

- A more systematic advance comparison of means by criteria derived from the ends selected.

- A more candid and effective assessment of results, usually including a system of keeping track of progress toward interim goals. Along with this goes a "market-like" sensitivity to changing values and evolving ends.

- An effort, often intellectually strenuous, to mobilize science and other specialized knowledge into a flexible framework of information and decision so that specific responsibilities can be assigned to the points of greatest competence.

- An emphasis on information, prediction and persuasion, rather than on coercive or authoritarian power, as the main agents of coordinating the separate elements of an effort.

- An increased capability of predicting the combined effect of several lines of simultaneous action on one another; this can modify policy so as to reduce unwanted consequences or it can generate other *lines* of action to correct, or compensate for, such predicted consequences. (Way, 1967:95)

As a response to the complexity of large scale organizations

The new style can deal with that by distributing to a larger and larger proportion of the population responsibility for the decisions that shape the future. It can also inculcate a common style of action among business managers, government officials and university professors; already, more and more people are circulating freely through all three of these formerly walled-off worlds. By mobilizing specialized and value-free science to work on practical problems, the new pattern can help restore the community of scientists and scholars and build an organized link between science and value. (Way. 1967:95)

This development has not taken place without its confusions. They have stemmed largely from false assumptions about computers as artificial intelligences and about the omniscience of experts. Given these assumptions, systems management can be conceived of as a great strengthening of the totalitarian design. It has taken time to realize that:

- Decision-making and judgment cannot be reduced to the narrow band of formal logical structures to which computers are restricted (cf. Cowan, 1965; Dreyfus, 1965).

- Optimization techniques can take into account only those uncertainties concerning the future that can be identified beforehand. Through optimization, furthermore, we can develop a control unit or monitor to be *added to the system* to deal with these predictable uncertainties--but we cannot provide a control unit that is *built into the system*, leading to increased self-control of the units already in the system. (Ackoff, 1966)

- The rationality of a social system is not a property of an isolated part (however expert); it is a property of the system of

which the experts are only a part, occupying a position in
relation to all the other parts. The design of inquiring sub-
systems has become one of the very pressing problems because
"wherever centralized planning begins to narrow the ability of
individuals to express themselves in certain traditional ways,
then the system has become less effective and the system scientist
should translate the lack of freedom in the system into a
deterioration of the system effectiveness." (Churchman, 1968)

Systems management and the UK/Norwegian experiments are still very
small developments and it may seem unwise to read too much into them. We have
felt more confident in our interpretation because it has been possible to
identify some features of the general organizational response that would be
adaptive in turbulent environments. What stands out from our own experience
(not least from our attempts to devise a more appropriate organization for our
own peculiar social situation) is that the characteristics of the turbulent
field require some overall form of organization quite different to the
hierarchically structured forms to which we are accustomed. Whereas the Type
III environments require one or other form of accommodation between like but
competitive organizations (whose fates are to a degree negatively correlated),
*the turbulent environments require some relationship between dissimilar
organizations whose fates are basically positively correlated*; that is,
relationships that will maximize cooperation while still recognizing that no
one organization could take over the role of the other. For obvious reasons,
we are inclined to speak of this type of relationship as an *organizational
matrix*: it delimits the shape of things within the field it covers, but at the
same time, because it delimits, it enables some definable shape to be
achieved. While one aspect of the matrix provides a conference within which
the ground rules can be evolved, another independent but related aspect must
provide for the broader social sanctioning. Insofar as the sanctioning
processes can be concretized in an institutional form, it should be possible

for the conferences to have the degree of secrecy and protection that is required if the component organizations are to retain an effective degree of autonomy and engage in effective joint search for the ground rules. It is possible to foresee that within the domain covered by such a matrix there would need to be further sanctioning processes to enhance the diffusion of values throughout the member organizations. This appears to be one of the functions exercised by professional bodies.

It should be noted that, in referring to the matrix type of organization as one possible way of coping with turbulent fields, we are not suggesting that the higher level sanctioning can only be done by state controlled bodies, nor are we suggesting that the functioning of these matrices would eliminate the need for other measures to achieve stability. Matrix organizations, even if successful, would only help to transform turbulent environments into the kinds of environments that we have discussed as "clustered" and "disturbed-reactive." Within the environments thus created, an organization could hope to achieve stability through its strategies and tactics. However, the transformed environments would not be quite identical. Thus, the strategic objective in these transformed environments can no longer be stated in terms of optimal location (as in Type II) or capabilities (as in Type III). The strategic objective has to be formulated in terms of institutionalization. As Selznick (1957) states in his analysis of the leadership of modern American corporations:

- The default of leadership shows itself in an acute form when *organizational* achievement or survival is confounded with *institutional* success. (p.27) .... The executive becomes a statesman as he makes the transition from administrative management to institutional leadership. (p.154)

This transition will probably be rendered easier as the current attempts to redefine property rights clarify the relations between the technologically

productive area and the total social system. Private property rights are being increasingly treated as simply rights of privileged access to resources that still remain the resources of the total society. To that extent, the social values concerning the protection and development of those resources become an intrinsic part of the framework of management objectives and a basis for matrix organization.

The processes of strategic planning are also modified. Insofar as institutionalization becomes a prerequisite for stability, the setting of subordinate goals will necessitate a bias toward those goals that are in character with the organization and a selection of the goal paths that offer a maximum convergence of the interests of other parties. Hirshman and Lindblom (1962) have spelt out in some detail the characteristics of policy-making under these conditions of environmental complexity, uncertainty and value conflict. Our own detailed studies of the decision processes in large scale systems lead us to agree with them that these processes are most effective when they allow for the coordination that arises from the mutual adjustment of the values and interests of the participants, even though these social processes may not be consciously directed at an explicit goal, and decision processes are characterized by *disjointed incrementalism*.

What we have been predicting is the emergence of a process, not a particular event. We think that the outlines of the process can already be detected and that it is a process which could evolve both the values and organizational structures which can transform our present social environment. If one wishes to predict in more detail, it is necessary to consider more closely the technological/productive area, its leading part, the informational technology and those characteristics of the other social areas that will affect the diffusion of change throughout the system. If one wishes to qualify these predictions, it would be necessary to consider the wider international setting.

Conclusion

Space prevents further analysis at this level of detail. We can only list the matters we would have wished to deal with.

In the technological/productive area the significant changes include growth in GNP; growth in productivity; growth in range of what can be produced; increasing indirectness of human contribution to the productive process.

Among the social and human effects that need to be considered are changes in the salience of such human affects as distress becomes less dominant. Cultural differences should be considerable; the shift in balance between the portion of life given over to work and leisure; the shift in balance between the man/nature and man/man relations.

In the field of information technology the significant changes are: the shift in balance of costs between communication and transportation; computerization of an increasing portion of object/object relations and man/object relations where man can appropriately be considered as an object (e.g., allocating a man to an aircraft seat). This makes possible a shift in salience; the shift in balance of distal and proximal communications.

The range of social and psychological effects may be no less extensive than what one would expect from a major mutation of the species. Of particular concern are the effects on man's perception of himself and his world. As Arendt (1958) and Kuhn (1962) have argued, these types of changes are fundamental in the evolution of society and of science. It is assumptions about these things that tend to determine the way men use and develop their technological apparatus.

Because information technology is the leading part in the technological/productive system, we can expect it to have a major formative influence upon work and learning for work. We would certainly expect the nature of work and learning to change and it is possible that the radical changes in information technology are producing radical changes in these fields.

The boundary conditions of the modern industrial societies are not

likely to remain constant throughout the next 30 years. Two main sets of conditions have attracted attention: qualitative and quantitative changes in the population inputs to the world society; qualitative and quantitative changes in the other resources available to the world society.

These variables are not independent of social action and hence cannot be predicted from their previous trend lines. The modern industrial societies are such a leading part that their own actions can affect these variables. This creates for them a range of relevant choices. They are, however, still only a part of the world society. The choices they make will be molded by the relationships they develop with the others, particularly as their individual fates are becoming more closely integrated and their contacts increasing. These very conditions may reveal deep cultural fissures that were irrelevant in the earlier imperialist phase but are now becoming critical.

It should be possible to explore the effects these types of changes could have upon future development.

Throughout, there has been no attempt to identify the particular contributions that social science should make. We have assumed that the first task was to identify ways in which our anticipations could be improved; secondly to venture a few of the broadest guesses. It would be a further task to see what specific social science developments would best help meet the anticipated problems and possibilities.

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