The Next Thirty Years: Concepts, Methods and Anticipations

F. E. EMERY[1]

(Emery 1967)

I. PREDICTION AND PLANNING

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

There is a common feeling that men's needs for understanding and controlling themselves and their societies may, in the next thirty 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 thirty 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 for 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 social sciences in under five years. (For major projects like those of *The Authoritarian Personality,* or Bruner's *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 ten years is not enough to guide effectively current decisions on investment.

Within the time scale of from five to ten 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 twenty to thirty years, but in no way 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.

[1] Dr F. Emery is a member of the Human Resources Centre of the Tavistock Institute of Human Relations. A biographical note appeared in *Human Relations,* 1965, **18,** p. 32.

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 to 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 thirty 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 ten thousand 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 re-organization of industrial culture that would radically change the multiple effects of the educational psychologist or the pre-eminence 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 thirty 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, 1965, p. 52). Jerome Bruner in his presidential address to the Society for the Psychological Study of Social Issues (1964) 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 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:

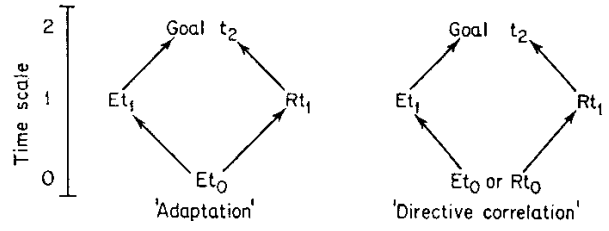

FIGURE 1

Both of these diagrams depict causal processes linking initial states at t_0 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.

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 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 sets 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 c*oenos—beginning)* for a range of other purposive activities.

To be applied to the next thirty 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 directively 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 elaboration 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 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 outmaneuver 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, p. 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 thirty 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 to be 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.

Summary

In this section we have sought to argue that:

(a) there is a need for developments in the social sciences that go beyond their present concerns;
(b) this development needs planning;
(c) the planning needs to be in a context of expected social developments for several decades ahead;

(d) the planning should be more than projection or forecasting;
(e) planning should actively seek to extend the choices men can make, not to dictate them.

II. CONCEPTUAL BASES FOR PREDICTING THE FUTURE

Even if we agree about what ought to be done by way of planning, we are no further advanced with respect to (a) knowing how to detect social developments several decades ahead or (b) knowing what developments we should actually plan for. In this section we will examine some of the concepts and methods that might help us to determine the shape of the future. After this we can tackle the main question of what future.

A prediction of the future can always be challenged by pointing out that we can only know what we have experienced or are experiencing—that the future does not yet exist and hence cannot be experienced, cannot be known. This scepticism reduces itself to the position that we can know only what is presently experienced because the past is also non-existent and we have no way of experiencing and hence knowing whether what we *think* was experienced was actually experienced. These objections cannot be allowed to rest there. To be consistent one has to define what is the `present', and if one insists that past and future do not exist and hence cannot be known then the present becomes the split second of immediate experience and knowledge; knowers and knowables disappear.

This attitude to prediction is no more useful to understanding what we actually do than is the other Laplacean extreme which suggests that the past and future are completely given in the present array of matter and energy. Our own experience of successful and unsuccessful prediction is a far better guide to what we might be able to achieve in trying to assess the future requirements for the social sciences. Granting the compelling point that we cannot experience that which does not exist we are still prepared to agree that we know something scientifically if we know we could, given present conditions, create the relevant experiences (by experiment, test or observation). This copes not only with why we believe that we know something of the past, but also with why we believe we know something about the future, e.g. we can experimentally demonstrate that exposure to present conditions will lead to a particular set of events at some point in the future. At a trivial level we can say that, given the numbers sun-bathing today, there will be many more with sun burn tomorrow.

These latter considerations give us good reason for rejecting a sceptical viewpoint about prediction and accepting the question more usually asked by Everyman `How do you know that ?'—allowing that only under some special circumstances will he ask 'How *can* you know that?' However, we have in our riposte implicitly redefined the notion of present. The present within which we can potentially carry out a confirmatory experiment or collect the ingredients of sun burn is not the immediate conscious present of the sceptic. Is this simply a sleight of hand or are there other grounds for redefining the notion of `present', apart from the fact that 'the immediate present' is an impossibly useless concept?

This problem was brought to a head in psychology with Lewin's concept of contemporaneous causation as applied to the life space of an individual. Lewin, and subsequently Chein, suggested that, just as much of the present is organized into spatial gestalts, so the present is embedded in *`overlapping temporal gestalts'.*

The experience of a melody presupposes experience of a temporal gestalt. A sneeze can be part of the present but so is middle age part of the present of a middle aged person and the sixties part of the present of a railway organization. Any person or group is at any instant in many `presents', each corresponding to what is a phase of the temporal gestalts in which he or it is embedded. In dealing with living systems, whether species, population groups or individuals, we have been led to the viewpoint that there are laws corresponding to the whole course of a living process. This is because we have

identified in these processes parts which coexist throughout the duration of the process, and in their mutual interaction and interdependence generate the causal relations characteristic of that process. Certain (not all) of the characteristics of events arising within a process, or the emergence of phases of a process will be determined and hence can be predicted by the laws governing that process. However, by the same reasoning, the phases will possess certain characteristics of their own arising from the mutual determination of their subparts; and hence laws of their own. These characteristics will not be determined by the characteristics of the preceding phases unless these arise from laws of the total process and except in so far as the preceding phases determine the starting point of the phase in question. Sommerhoff has stated these propositions in a more rigorous and exact way in his concepts of long-, medium- and short-term directive correlations (corresponding to phylogenetic, adaptive learning and behavioural responses) and of the hierarchies that can arise between them. For our purposes, it is enough to note that it is consistent with the principle of contemporaneous causation to regard certain types of past and present events as causally related to and predictive of events that have yet to occur or to be experienced. These are the events that arise in the course of the process and are mutually determined by the laws that govern that process. In psychology, for example, the facts of maturation and learning are of this type. The pre-requisite for prediction is a knowledge of the developmental laws. In the absence of this knowledge even the meaning of the immediately present facts cannot be understood; we can even regard it as being theoretically impossible to gain this understanding by knowing all about every immediately present fact. (This is the problem of Laplace's super mathematician and the illusion of some super computer schemes for integrated data systems.) In addition to a knowledge of the laws governing different classes of living processes, we need a knowledge of earlier facts if we are to know how those laws are operating in a specific individual process, and hence to know the effects they will have on later phases.

So far we have considered only the case of a single process (`temporal gestalt', system or `directive correlation') and its parts, and have implied that the whole burden of causation is within a process. This is, of course, a travesty of reality. Many of the phenomena we observe arise from the interaction of processes that we are unable to treat as if they were parts of a more inclusive process. When such interdependent processes overlap, a new process emerges and a class of events is generated which has no history prior to the beginning of the interaction. There are clearly degrees of independence. The interpersonal life that will emerge in the marriage of a man and a woman from the same culture is probably more predictable than that which would emerge if they came from different cultures. In any case, these hybrid processes seem to entail a special degree of unpredictability. The sufficient conditions for these newly emerged classes of events cannot be found in the prior history of the individual processes.

Our main suggestions about the theoretical possibilities and limits for prediction can be spelt out more clearly with reference to simple diagrams. Throughout, we will be concerned with predicting the future of concrete individual processes (e.g. of the U.K. or of John Smith). We will not be considering how one builds up predictive knowledge for a class of repeated or repeatable processes, nor will we consider forecasting techniques for processes that display only quantitative change.

Let us assume that figures A, *B*and *C* in *Figure 2* represent the scope and temporal extension of two living processes (which could, for instance, be ecological, social or psychological). Let t_o represent the present and *t--, t-, t+* and *t++* represent past and future points in time.

In the situation represented in *Figure 2,* we would expect to be able to predict the state of *A* at *t+* better than we could *B* at *t+* (provided, of course, that *A* and *B* are the same kinds of system). The general principle is simply that for any system there is a minimum number of its component positions that have to be filled by parts before the system is recognizable. In practice, we do find that the more of

its course a system has run, the easier it is to understand. On the same grounds we would regard *C* as unpredictable at t_o.

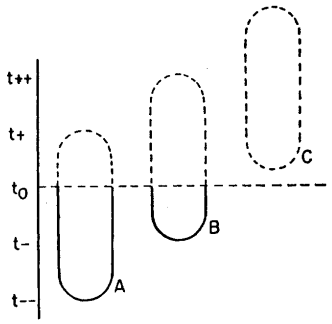

FIGURE 2

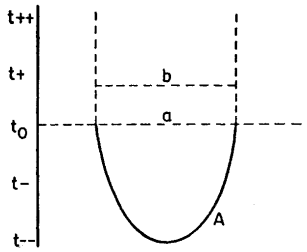

FIGURE 3

Figure 3 represents a situation where *a* and *b* are phases of *A.* While some prediction about the future part of *a* is theoretically possible, there is no basis for predicting the specific characteristics of phase *b.* Beyond phase *a* one could only make predictions of the kind discussed with reference to *Figure 2, i.e.* predictions about the more general features of system *A.*

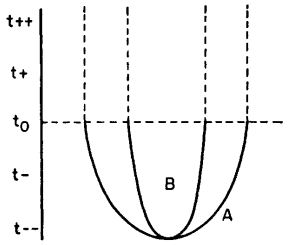

FIGURE 4

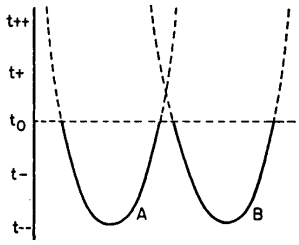

FIGURE 5

Figure 4 represents a situation where *A* and *B* are coextensive in time but *B* is a part process of *A.* One would expect that predictions about *A* would theoretically be easier than predictions about *B.* The basis for this expectation is the general property of part-whole relations. *A* sets some of the parameters of *B* and hence, whatever one knows of the values likely to be taken by *B,* one knows more if one knows how these parameters might change. The future of *B* is dependent upon the future of *A* in a way that *A* is not dependent upon *B.* At the same time, predictions about *A* will be less specific than could be predictions about *B.*

In *Figure 5* we have two processes which are presumed to interact after some point t+ in the future. If *A* and *B* survive the interaction, some of their system properties may predictably survive. What seems unpredictable are the processes set up by the interaction and the changes occurring in *A* and *B* if they become directively correlated to form a larger inclusive system.

It would be too much to expect that the above mentioned situations constitute a complete set or that our interpretations are all equally defensible. It will suffice if we have made the point that there are genuine theoretical questions involved in predicting the future (as distinct from methodological ones) and if we have explicated our own assumptions. These assumptions will guide our search for appropriate methodologies and our strategy for identifying future changes.

III. METHODOLOGIES FOR PREDICTING THE FUTURE

Given the conceptual model of overlapping temporal gestalts (`processes', `systems' or `directive correlations'), the general methodological problem is clear—to identify 'the constructive principle' (ends or `focal condition') that characterizes the system or sub-system whose development we are trying to predict. A good methodology will be one that enables us to predict earlier.

There are two aspects to this methodological problem:

(a) to identify the system in terms of what are its components and the dimensions in which they are arranged. This is not simply a matter of counting off those things that display a sufficient degree of interdependence to warrant being treated as a system. Most systems, particularly in their early stages, are incomplete (`open gestalts') and hence system identification can only be considered adequately if one can enumerate not only the present members and their relations but, from these, also the unfilled positions in the system and the strains they create. The notion of incompleteness is implied in statements of the sort that political system *X* or person Y is immature.

Under this aspect we can classify the modes of prediction that Bell refers to as `structural constraints' and `requisites', and `operational systems' and `codes'. These identify major system characteristics and lead to predictions of persistence or decay. Also here is the mode of predicting from the `overriding problem' (í.e. the goal of the system), 'the prime mover' (the basic starting condition or coenetic variable) and `phrase theories' (identifying a temporal hierarchy of goals and starting conditions).

(b) to identify the characteristic generating functions of the system. The underlying notion here is that insofar as a system generates its successive phases, it will exhibit some temporal series of behaviour which, if quantified, could be represented by a mathematical series. These mathematical series have the property that their characteristic generating function can be identified from a finite part of the series (even if the series is infinite), and, given the c.g.f., one can predict from any starting point the subsequent members of the series.

These two aspects are not always explicitly dealt with in published models of prediction. In the mode that Bell calls `social physics', we have had many attempts to postulate the characteristic generating functions of identifiable systems (Marx being a classical instance). However, in the mode of `trends and forecasts', we typically find that the models deal with *aspects* of a system without explicitly relating these aspects to the behaviour of the total system. By taking more aspects, as in the current U.S. government move from national income accounting to `social accounting', these models may move closer to predicting total system behaviour. This is particularly likely if, as in the quoted case, the selection of new aspects to measure is guided by explicit analysis of the system.

Bell's concern was with modes of predicting future states of *large complex social systems.* This is also our concern, so it is relevant to discuss several special difficulties that arise with studying these systems:

(a) their complexity is greater than that which we have so far learnt to cope with in our separate social sciences;

(b) the sharing of parts between different sub-systems is so great that their subordination to newly emerging processes can be difficult to detect—the parts appear to be still functioning as parts of the established familiar systems although perhaps a little more erratically.

The first difficulty has been taken up by Ashby in *Design for a Brain.* He points to the insuperable difficulties that confront a methodology that seeks to build up a picture of such systems from a representation of all the parts and all their interrelations. He proposes a methodological approach like that which Lewin attempted, prematurely, with his topological representation of the genotypical characteristics of the individual life space. With living systems, the most fundamental genotypical characteristics are the system-environment relations that determine survival (i.e. continued living). In populations of living systems, each is part of the environment of the others and hence they constitute together a social field. If we take this social field as a superordinate system then the first and most general question is `What are the system-environment relations that typically determine survival in this

super-ordinate system?' It should be noted that this question is not directed to each part in turn but is directed to all parts at once, both as systems in themselves and an environment to the other parts. Answers to this question should tell us, if only in a very general way, the challenges and possibilities that will guide the future development of the system.

To our knowledge there has been less clear and explicit analysis of the methods appropriate to the next question—`What are the tendencies in the system toward generating the conditions that make adaptive survival behaviour possible?' There seem to be at least two approaches. First, the demands for survival in a particular environment should place value on certain kinds of preparatory behaviour at the expense of others; changes in the conditions of survival should induce changes in these values (goals). The direct study of what is valued should therefore enable considerable enrichment of the predictions that could be made from study of survival conditions alone. Several specific methodologies have been suggested for studying values.

Ackoff and Churchman have argued that where we have a reason to believe that something is a value for a social system, we can test this belief by seeing whether there has been, over an appropriately long period of time:

(a) a tendency to increase the efficiency of the means for pursuing this something;

(b) a tendency to greater use of the more efficient means;

(c) an increased conscious desire to achieve this something.

(a) and (b) could be otherwise formulated as an increase in the range and degree of the directive correlation having this something as a goal. (c) is a necessary condition because both (a) and (b) could be manifested by a process that arises from the accidental overlap of two temporal gestalts (as in *Figure 5* above). In the case of warfare we can certainly see an increase in the efficiency of weapons and a marked tendency for their usage to spread, even to warring Congo tribesmen. The absence of condition (c) gives some grounds for doubting whether the wholesale murders of others is a basic social value.

As a methodology, the Churchman—Ackoff proposal seems a particularly promising start. The most desirable elaboration of this method is probably that which will help order the relation between values. Their own discussion of the concept of sacrifice suggests how this might be done. One can readily envisage how this method might help us predict the longer term shills in value that plague the `trend and forecast' men.

A more popular methodological approach to the same problem is provided by the combination of sample surveys and value tests. This is essentially limited to part (c) of the Churchman—Ackoff model and hence, for use as a basis for prediction presupposes some evidence about (a) and (b). Without the latter, one cannot be sure whether the support for a value is, over the long run, declining, stable or growing.

The second methodological approach to complexity at this level of generality is that of identifying the starting conditions (coenetíc variables) that have arisen from the past adaptive responses and act as a constraining and guiding influence on subsequent preparative behaviour. This has appeared to be the really scientific approach during those past generations when the value oriented actions of men so frequently produced unanticipated and undesirable consequences. One marked attraction has been the appearance of a social system in which the vast complexity of past individual contributions has been congealed and crystallized into a much fewer number of formal organizations. The state of these organizations at any one time seems to be a firm basis for what will subsequently emerge. Combined with a variant of the first method—analysis of the values pursued by organizations—it seems particularly attractive. However, the individual orientations left out of this approach may well nullify this attempt to reduce complexity. Developments like those of Nazi Germany suggest that these `residual' non-organized behaviours are an important condition for what will emerge in a society.

Both of these methodologícal approaches appear in practice to achieve less than the necessary reduction in complexity. Almond's model, for instance, would require repeated sampling of several hundred sub-samples of organizations. Similarly, the range of values that can conceivably be supported in a human population is excessively large.

This leads us to suggest that there is a methodology intermediatory to the Lewin—Ashby model and these. The intermediate one concerns the notion 0f *`the leading part'.* In this case, the reduction is not, as it were, a reduction across the board to pick out a key element in all of the parts. Selecting the leading part seeks to reduce the total complexity by ignoring a great deal of the specific characteristics of all but one part. At its extremes we have the reduction to a figure-ground relation in which the leading part is considered in relation to all the other parts taken together as its ground (the environment it has which is internal to the total system). Throughout this range of possibilities the method is basically that of establishing which part it is whose goals tend to be subserved by the goals of the other parts or whose goal achievements at t_o tend to determine the goal achievement of all the parts at *t+.*

Practical use of the methods of value study or structural analysis usually involves an implicit assumption about what is the leading part, e.g. McClelland's study of achievement values and the mode of production theory. The values of the elite or the character of a central organization (or set of like organizations) can readily form the basis for predictions about the future. There would be a better basis for prediction if the intermediate step of selecting the leading part has an explicit methodological basis. One expected windfall from asking 'What part acts as the leading part?' is that major phase changes might be identified. Most studies of developmental phases in individuals or societies seem to identify a change in phase with a change in the leading part.

These suggested methodologies do not add up to an established discipline for study of the large complex so-called 'socio-economic-technological systems'.[2] They do indicate that this order of complexity is not an insurmountable barrier and that progress has already been made.

The second major difficulty, that of early identification of emergent processes, poses far more perplexing methodological problems. In our first general grouping we did manage a formulation of the problems and the possible lines of solution. Because our subsequent thoughts may be even less generally acceptable, we will first reproduce this initial formulation then proceed further. If social life is properly characterized in terms of overlapping temporal gestalten, then many of those processes that will be critical in the future are already in existence in the present. If this were not the case, it would be difficult to see how such processes could quickly enough muster the potency to be critical in the next thirty years. Thus, for instance, the conditions for World War I were laid before the end of the 19th Century, and correctly perceived by such oddly gifted men as Engels and Bloch.

An obvious question must be asked at this stage: `Is this not the same class of evidence that is the basis for extrapolative prediction?' Such evidence does include some evidence of this class, but its most important additional inclusion is of processes that are not recognized for what they are. The early stages of a sycamore or a cancer are not obviously very different from a host of other things whose potential spatio-temporal span is very much less; similarly, as regards many processes in social life.

One suspects that the big emergent processes of social life are typically like this. They emerge, they grow and only then do people realize that their world has changed and that this process exists with characteristics of its own. Granted that there are genuine emergent processes (otherwise why the

[2] The phrase `socio-economic-technological systems' has been used in M.I.T. contributions to the Year 2000 Commission. It appears to derive from the Tavistock Institute of Human Relations use of `socio-technical systems'. For our part, we think it misleading. A society is composed of socio-psychological organizations and socio-technical organizations, and at the same time is a population or aggregate of individuals. There are economic, political and affective aspects to all organizations.

difficulty about the next thirty years), then we must accept real limitations upon what we can predict and also accept that we have to live for some time with the future before we know it.

It is not simply foolhardy to think that we may enable ourselves more readily to recognize the future in its embryonic form. There are almost certainly regularities about these emergent phases. Social processes which, in their maturity, are going to consume significant portions of men's energies most likely have a lusty growth. They do not, by definition, command human resources at this stage, and hence their energy requirements must be met parasitically, i.e. they must in this phase appear to be something else. This is the major reason, we think, why the key emergents are typically unrecognized for what they are while other less demanding novel processes are quickly seen. A social process which passes for what it is not should theoretically be distinguishable both in its energy and informational aspects. Because it is a growing process, its energy requirements will be substantially greater (relative to what it appears to do) than the energy requirements of the maturer process which it apes. Because it is not what it appears to be, the process will stretch or distort the meanings and usage of the vocabulary which it has appropriated. The energy requirements may be difficult to detect not only because we lack scales for many of the forms of psychic and social energy, but also because a new process may in fact be able to do as much as it claims (e.g. T.V. to amuse), but do it so much more easily as to be able also to meet its own special growth requirements. The aberrations of linguistic usage are, on the other hand, there to see.

In trying to go further along these lines, we will first try to explain why there are probably significant processes operating in the present although undetected. The explanation we will give itself suggests some methodologies that might aid early detection. For reasons of continuity we discuss these before tackling the logically prior question of whether there is any particular reason for trying to achieve early detection.

Complex social systems like the human body rely a great deal on the *sharing of parts.* Just as the mouth is shared by the subsystems for breathing, eating, speaking, etc., so individuals and organizations act as parts for a multiplicity of social systems. Just as there are physiological switching mechanisms to prevent us choking too often over our food, so there are social mechanisms so that we do not have too many Charlie Chaplin dashing out of factories to tighten up buttons on women's dresses (in *Modern Times).* We now think that it is this sharing of parts that enables social processes to grow for quite long periods without detection. If they could grow only by subordinating parts entirely to themselves then they would be readily detectable. If, however, their parts continue to play traditional roles in the existing familiar systems, then detection becomes difficult indeed. The examples that most readily come to mind are the pathological ones of cancer and incipient psychoses. Perhaps this is because we strive so hard to detect them. In any case, healthy changes in physical maturation, personality growth or social growth typically follows the same course. Once we are confronted with a new fully-fledged system, we find that we can usually trace its roots well back into a past where it was unrecognized for what it was.

If this is, in fact, the reason for most or even some important social processes being undetected, then it suggests methodological approaches. Despite the redundancy of functions that the parts tend to have with respect to the role they play in any one sub-system, one must expect some interference in the existing systems as a new one grows. Angyal, from his analysis of competing psychological systems, has suggested a general classification that could serve as a basis for analysing social systems. This is as follows:

1. When the emerging system is relatively very weak, it will tend to manifest itself only in the parasitical effects it has on the energies of the host system—in *symptoms of debility.* These latter will find it increasingly difficult to mobilize energy (people) for their functions and there will be a slowing down of their responsiveness to new demands. The balance of forces may

oscillate so that these symptoms occur in waves and make the functioning of the existing social systems less predictable.

At any time a social system experiences a fair amount of uncontrolled variance (error) in its operations. The reasons for an increase in this variance, of the kind we are discussing now, will typically be sought for inside the system itself, and measures may be taken to tighten up its integration. The unpredictable oscillatory effects are likely to encourage a wave of experimentation with new modes of system functioning. All these symptoms have behavioural manifestations and are hence open to study. The methodological strategy of operational research is that of proceeding via analysis of the variance of systems and this would seem particularly appropriate here.

2. When the emerging system is stronger but still not strong enough to displace the existing system, we can expect to see *symptoms of intrusion.* What breaks through are social phenomena, like the swarming adolescents at Margate several years ago, which are clearly not just errors in the functioning of the existing systems. At the same time, because of the relative weakness of the emerging social systems, they will usually only break through because they have short circuited or distorted the functioning of the existing systems. Their appearance will not obviously reveal the shape of the emerging system. However, if we are aware of the possibility that these phenomena can arise from emerging systems, it should not be beyond our ingenuity to develop appropriate analytical methods (as has been done in psychology for detecting from slips of the tongue the existence of competing psychological systems).
3. When the emerging system has grown to be roughly in balance with the existing systems there may be *mutual invasion.* At this stage it should be obvious that there is a newly emerging system but mutual retardation and the general ambivalence and lack of decisiveness may still lead the new system to be seen simply as a negation of the existing system. The methodological task is to identify, in the chaotic intermingling of the systems, characteristics of the new system which are not simply an opposition to the old. Once again we find that this is not an entirely new methodological problem for the social scientist. The Lewinians gave considerable attention to this in their studies of `overlapping situations' including such phenomena as adolescence when new and old psychological situations are frequently invading each other. Barker, Wright and Gonick specified five dimensions that they found helpful to sort out what was being done to what, by what. These dimensions are consonance, potency, valence, barriers and extent of sharing of parts. With the aid of these dimensions, they were able to spell out many of the behavioural properties of invading systems. These conceptual dimensions have been sufficiently well defined to permit ready translation into other theoretical schemes.

The fact that early detection may be possible does not in itself make it worthwhile pursuing. The fact that early detection increases the range of responses and hence the degree of control a system has over its development does make us interested. There are facts about the growth of social change that suggest that each unit step in the lowering of the detection level will yield a disproportionately greater increase in the time available for response. Put another way, it would yield a disproportionately richer projection of the future from any given time.

The next points we wish to make by referring to *Figure 6.* Let lines *A* and *B* represent two courses of growth over time. If social processes typically grew in the way represented by curve *A,* then we might well feel that early detection was not a pressing problem. At this steady rate of growth, we might expect that when the scale got to the level of ready detection *(D* on the vertical axis) we would still have the time *c—a* (horizontal axis) in which to aid, prepare for or prevent the new system getting to critical size *(C* on vertical axis). All of this is simple enough and the assumptions do not seem

unreasonable because so many of the changes in the physical world and in our physical resources do grow in something like this manner.

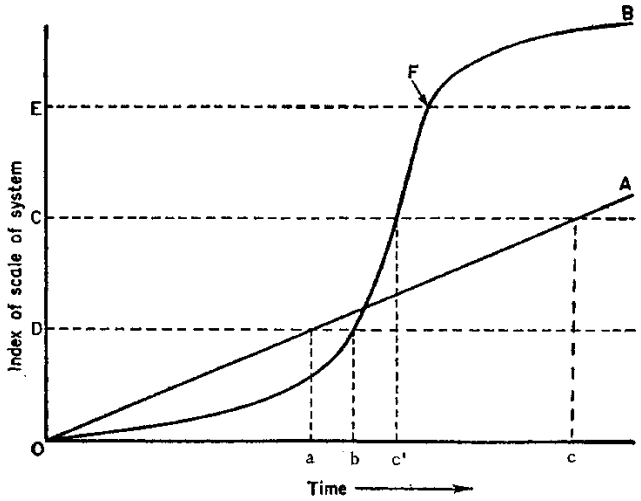

FIGURE 6

In fact, a great many of the growth processes in social systems appear to be more like that represented by curve *B.* These growth curves are common enough in all living populations (and some physical systems) where each part has powers of multiple *replication,* but in this case we are primarily concerned with *recruitment* of existing parts to a new social system. What appears to contribute most to the prevalence of type *B* growth curves in social systems is the fact that these possess *the property of highly developed symbolical communication.* What is absent (because it is past, distant, or as yet only anticipated) can be represented by one part to the other parts. Their mutual co-ordination and regulation is vastly extended, and so is as a result, the contagion of changes. One important implication of this is that a new system may, after a long period of slow and undetectable growth in the interstices of the society, suddenly burgeon forth at a rate which produces a numbing effect on the society, or at least drastically reduces the range of responses to it. The general notion may be explicated *by* again referring to *Figure 6. If* the point of critical size is somewhere near where we have marked in *C,* then it is in the nature *of* the type *B* curve that there will be less time between detection and critical size than would occur with a type *A* growth curve, i.e. $T(c'—b)<T(c—a)$.

Although, in this section, we have concentrated on the early detection of emerging systems, the present line of argument has implications for the fate of rapidly growing systems. The sort of growth that occurs between detection at point *D* and point *E* on *Figure 6* can only too easily be seen as a type *A* growth. Even if the growth up to point *D* is reconstructed, the curve *O* to *E* may be seen as a pure exponential growth curve which will continue on at an increasing rate of growth towards point *F.* To Price's discussion of this in connection with the future of science, we can only add the obvious point that the method of study should include our earlier proposals. The decline in growth rate may occur not only because there is a limited supply of recruitable parts, but also because new systems are competing for existing parts.

Once again we find that elucidating the general nature of social changes is a fruitful way of identifying methodologies for furthering our ability to predict change in individual social systems or processes. The sigmoid type of growth curve (i.e. our *B* curve) has been a potent tool in the study of all types of living systems.

There remains a further general class of methodologies for early detection. These derive in the first place from the fact that man is not just a symbol user in the way we have been discussing. His fundamental relation to his environment is a symbolical relation. As Tomkins has argued, our present

knowledge of man suggests that if our perception mirrors nature, our consciousness is a mirroring of this mirror by the conceptual ordering of our memories. The essential adaptive advantage is that the error inherent in this process makes learning possible. For our purposes the relevance is that man's responses are to the world as he symbolizes it and not directly to the world as it presents itself to his eyes, ears, etc.

In the second place, while this mechanism of consciousness is a condition for learning, the learning itself is not conscious (certainly not necessarily conscious). Thus man's symbolical representation of the world may change to represent changes in that world without him being conscious of the change. In so far as he is unaware of these changes they may remain unrecognized, or, if manifested in his behaviour be puzzling, trivialized, or segregated parts of his projected world picture.

We have dwelt on these properties of the individual human being because they are basic to any joint human activity whatever the scale or complexity. On available evidence, it would seem that men live and have always lived in 'a cultural world which is created and maintained by the symbolic transformation of the actual world and the imputation or projection thereon of the meaning and values by and for which we live' (L. K. Frank, from a presently unquotable source; see also Frankfort). Our second point about individuals seems also to hold for social systems, namely that the social symbols, the myths, beliefs, values, language, fads and fashions change without any necessary awareness of what the change means or to what they correspond. More concisely, there can be awareness of world changes without awareness of that awareness; and this awareness can be manifested in man's communicative behaviour as well as in his other behaviours. When these manifestations are recorded in oral traditions, in art forms or writing, it is theoretically possible that analysis of the records will reveal the existence of social processes which existed at the time, were sensed and lived with but not consciously grasped. At least three methodologies of different levels of generality have begun to emerge here. For convenience we label them as follows: (a) symbol analysis; (b) value analysis; (c) analysis of linguistic usage.

We use the term symbol analysis to refer primarily to the methods of Jung and his followers.[3] The ethologists and ecologists have together shown the nearly ubiquitous nature of symbols in living populations and their contribution to the natural selection of populations. Since this, it has been difficult to write off the possibility that the human species might have evolved through the use and selection of some similar innate cognitive programmes involving `perceptual concepts'. Less tentatively, we can accept the possibility that cracks and repairs in man's umbrella of symbols might well presage the obvious emergence of major social processes by a long period of time.

Neumann, Marcuse and McLuhan have made much of the notion that signs of our present condition were present in the painters, poets and writers of fifty years ago. As might be expected, McLuhan is particularly outspoken on this. He quotes Wyndham Lewis as writing: 'The artist is always engaged in writing a detailed history of the future because he is the only person aware of the nature of the present.' To this he adds his own judgement, that 'the artist is the man in any field, scientific or humanistic, who grasps the implications of his actions and of new knowledge in his own time' (McLuhan, 1964, p. 65). For these reasons, McLuhan sees his own method of detecting the future in the present as essentially an application of the analytical techniques of modern art criticism. Just because these methods are esoteric, we cannot afford to ignore them. There appears to be some logic in them and a potentiality worth exploring.

[3] On the same assumption that basic changes in the life conditions of large groups may be detected in symbolic changes, Bunn has speculated that we might be able to develop a method of inferring such basic changes from statistical fluctuations in psychomatic symptoms (as unconscious individual symbolization) and in the value of money (as in part reflecting aggregate psychological valuation). This approach cannot be ruled out.

The analysis of values has already been touched upon because this, like the analysis of symbols and linguistic usage, offers a radical reduction in the complexities with which we would have to deal. In each of these we would be using men themselves as a filter of what is important.

The analysis of linguistic usage is at one level a commonsense way of sensing the way a person is developing or the way a people are tending to go. The very way in which people are speaking about things is often a valid indication of changes in the way they are looking at the world, even though those who are observed insist in all honesty that they have in no way changed their views. This method is a basic ingredient of psychiatric practice. At the social level, it has been applied to the content analyses of films, women's magazines, etc., and, more intuitively, to tracing out the subtle shifts in the meanings of key concepts like `work', `leisure' and `justice'. Marcuse has given us a profound analysis of the relation between experience and linguistic. He sets the methodological goal of linguistic analysis as that of `analysing ordinary language in really controversial areas, recognizing muddled thinking where it ***seems*** to be least muddled, uncovering the falsehood in so much normal and clear usage. Then linguistic analysis would attain the level on which the specific societal processes which shape and limit the universe of discourse become visible and understandable.' (Marcuse, 1964, p. 195.) Drawing upon the empirical study of Karl Kraus, he specifies some of the features of the method:

> 'For such an analysis, the meaning of a term or form demands its development in a multi-dimensional universe, where any expressed meaning partakes of several interrelated, overlapping and antagonistic "systems". For example, it belongs:
>
> (a) to an individual project, i.e., the specific communication (a newspaper article, a speech) made at a specific occasion for a specific purpose;
>
> (b) to an established supra-individual system of ideas, values and objectives of which the individual project partakes;
>
> (c) to a particular society which itself integrates different and even conflicting individual and supra-individual projects.' (Marcuse, 1964, pp. 196-7.)

It will be noted that these are methods of gathering information about the different levels of system competition which we presented as the general model for early detection.

We mentioned earlier that these methods offered a reduction in the complexity which had to be coped with, because men will, if acting unwittingly, tend to symbolize the relevant changes and filter the relevant changes out for themselves. If acting consciously, they will typically see things through the ideologies of their times. This is, however, only a relative reduction. A further profound reduction may occur with a Blake or a Joyce. However, this may be of little use. How do we recognize a Blake or Joyce in our midst or understand what they are saying when they probably don't understand themselves? If these methods of analysis are to be effective, we shall still have to deal with samples of data that are very complex relative to our current analytical tools. It has been recognized that modern computers may bring us within reach of the point where the predictions of such highly perceptive individuals as McLuhan, Marcuse and Neumann can be converted to testable hypotheses. Stone's (1966) general inquiries programme is a long step in this direction, but it would still be necessary to identify the kind of system which one suspects is emerging. In other words, these methods complement the perceptive intuitive minds.

An example may illustrate and draw together some of the methods we have discussed under the heading of `early detection'. It is essential, of course, that we try to concentrate upon the general principles, not the concrete features of the example. Assume, for instance, that a resurgence of Nazism is thought to be likely in a given country. Early detection is desired in order to allow counteraction and yet it is expected that any such embryonic movement would actively seek to avoid detection until it had recruited enough strength to challenge existing social systems and overcome the conceivable counteraction. The recruitment of any particular individual can be hidden because recruitment does not

entail total subordination to the party. The recruit can still continue to function as civil servant, waiter, husband, etc., although there may well be some falling off in the enthusiasm with which he now carries out his duties or even some change in the way he conducts them. However, even if each recruit in turn recruits several others each year, the growth rate, while sigmoidal, would put off the achievement of critical mass in a large nation for a long time (and of course increase the probability of detection). Therefore, in a large nation, a resurgent Nazi party would need to use the mass media. (Clandestine leaflets, papers and wall slogans would intensify efforts at detection.) They would have to penetrate and use the media in a covert way in order to avoid detection. However, to use it at all they would have to shape the media content and style so that it propounded their *weltanschaung.* It is not impossible to do this and at the same time avoid detection and counteraction. The aim would be to reach and to nurture the thinking of like-minded persons and these will tend to be more sensitive to low intensity messages than all but perhaps the obsessed anti-Nazis. Secondly, people can learn from a large number of trivial cues without being aware of just what led to the learning. This latter counts heavily against the obsessed anti-Nazi. He may well come to the firm conclusion that a particular medium has Nazi flavour and yet be unable to put his finger on anything that constitutes evidence for demanding counteraction.

In this case, how would the methods of symbolical analysis help to test hypotheses about the emergence of such a concealed symptom? Briefly, they would involve some sampling of media content because of the sheer mass of material going through them. The sample, if it were to be at all sensitive, would have to be handled by computers. The computer programme would need to be so designed that it could detect metaphors of the sort that Jung thought central to Nazi thinking, values of the sort that McGranahan found to distinguish the Nazi Youth from the U.S. Boy Scouts, and the more complex problems of syntax, grammar, vocabulary and even typography which Kraus found so revealing. For practical purposes the last would have to be restricted to the controversial political universe of discourse where in any case the effects are more significant. By repeating the study over time it should, theoretically, be possible to determine whether there is an embryonic growing process, more than one centre of growth or simply unrepentant, unburied remnants. It should not be impossible to go beyond mere detection to inferring structural properties and system orientations that differ from assumptions based on past experience.

As an example this is not entirely satisfactory. The hypothetical social process is conscious of its ends, consciously striving to use the symbolic processes of the society and consciously seeking to avoid detection. The latter does not simply cancel out the first two features to make it equivalent to a blind social growth. Hence, although in this case symbolical analysis can only be usefully employed when the weaker system is strong enough to start intruding, it does not argue against symbolical analysis at the earlier stage when all that is present are symptoms of pressure.

Summary

In this section we have outlined the following:

1. Two aspects of the general methodological problem:
   (a) to identify the system in terms of its members and the dimensions in which they are arranged;
   (b) to identify the characteristic generating function of the system.
2. Social methodological difficulties that arise with predicting the future of large complex social systems:
   (a) complexity;
   (b) early detection.
3. Methods that have been developed or proposed for overcoming these difficulties:

(a) *Complexity*

1. Ashby's model for studying conditions for survival;
2. method of identifying 'the leading part';
3. models for studying subordinate goals (values), e.g. Ackoff-Churchman, Cantril;
4. models for studying the starting conditions for change (coenetic variables).

(b) *Early detection*

1. model derived from the properties of weakly competing systems;
2. sigmoid growth model;
3. models based on analysis of symbols, values and linguistic usage.

IV. 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 it will not be moulded simply by technical forces; we argued that processes existing in the present can reveal some of the basic choices that will confront men over the next thirty years; and, finally, we argued 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.

Following the conceptual scheme outlined in section II, we will move from consideration of the broader social systems to narrower ones. Following our own judgement, we will start from consideration of the total social field of entities such as the U.K. and U.S.A., 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. For reasons given in section III, we think that this method of proceeding is preferable to abstracting common phenotypical characteristic aspects such as the 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 (a) the relation of the modern Western nations to the more inclusive international system, (b) the biological inputs to the systems, and (c) 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

As pointed out in section II, 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 us 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, 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 behaviours 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 behaviours 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 behaviour of 'human-beings-in-cognitively-unstructured-situations' and of 'human-beings-in-overlapping-situations'. It is our belief that a great deal of so-called learning theory is of the same kind, e.g. behaviour in 'an overly simplified structured situation', in a `complexly structured or problem situation', in an `overly complex or puzzle situation'. Similarly, Chein 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, oligopolistic, 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 behaviour 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 centred 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 the correctness of the strategy. As a beginning we concentrated on that dimension of the environment which we would call its *causal texture.* By causal texture we mean, following Pepper, 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:[4]

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 `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 to Ashby's limiting case of `no connection between the environmental parts' (1960, S.15/4); to Toda's `Taros Crater' (1962, p. 169); and Schutzenberger's random field (1954, 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 bench-mark. 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 behaviour, e.g. Adler's `Sociology of Concentration Camps' and the experimental environments of the animal learning theorists.

   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', í.e. reserves (Simon, 1956, p. 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' (Simon, 1956, p. 134).

   A critical property that emerges from this has been stated very precisely by Schutzenberger, 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' (1954, 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, p. 197). However, in these kinds of environments, information capacity can make an enormous difference to survival chances. Thus Simon, 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 environ-ment 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 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 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) (1960, p. 199). Much the same point is made by Simon and Tomkíns. Along with Ashby they postulate that survival in

[4] Any attempt to conceptualise 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.

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 firm 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, p. 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 organízation 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:

i. 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;
ii. the development of a hierarchy of strategies as in the rules for trouble-shooting in complex equipment;
iii. the assignment of step functions to the values of goals and noxíants instead of trying to act on a continuous range of values;
iv. 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 to Ashby's ultrastable system of the economists' oligopolistic market. In this we simply postulate a Type 2 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 1 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 2 environment because the survival of the individual systems requires some strategy as well as tactics. In the Type 2 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 ís 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, p. 209.)

How can competing organizations constitute a stable unit in a Type 3 environment? Given the relatively static nature of the environment within which the competition occurs, then it is possible (as it was for the individual organization in a Type 2 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 2 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 point out (1962), the models yield predictions of inherent instability despite the observable fact that stability is commonly achieved. Ferguson and Pfoutts do show that stability can be deduced if one postulates information flow and learning, however (1962). 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 2 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[5] of campaign in which are involved a planned series of tactical initiatives and calculated reactions by others and counteraction.

[5] Cf. the use by German and Soviet military theorists of the three levels—tactics-operations-strategy.

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 of 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 fora 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 1 environment if other systems can be characterized as goals or noxíants—they are either absorbed for the temporary sustenance they afford, or else avoided because noxious. It is another thing in a Type 3 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 3 and unlike Types 1 and 2, they are dynamic environments. Unlike Type 3, we 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, these environments that represent a transformation of Type 3 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 4 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 2 and 3 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:

   i. The growth to meet environment 3 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 in the environment (we are here postulating an effect similar to that of a company of soldiers marching in step over a bridge).

   ii. 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 organizations 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 source' 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 kinds of advertising.

For the organization, these changes mean primarily a gross increase in their area of *relevant uncertainty.*

iii. 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 3 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.

iv. 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 and politicians etc. to fly together than to correspond. We may recall that Trotter, in searching for the conditions underlying social reactivity in living populations, postulated only two critical conditions: (a) some special sensitivity to their own kind; (b) 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' behaviours.

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 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 ultra-stable 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 manmade 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 thirty 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 (section II), survival questions are basic ones and, insofar as our societies take on Type 4 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 nor 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 down-grade 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 defence 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 behaviour are publicly explored. The dominant mode at present seems to involve some form of *trivialisation*—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 behaviour—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 behaviour 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 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' (Marcuse, 1964, 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 emphasises that:

> 'The preconditioning does not start with the mass production of radio and television and with the centralization of their control. The people enter this stage as preconditioned 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.'* (Marcuse, *ibid., p. 8;* our italics)

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 behavioural 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 behaviour and are outcast as alcoholics, perverts, beatniks or eggheads. In so far as these people are an identified source of social variance, then 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 4 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 U.S.A., that that society can be characterized as a 'me dimensional society' and, further, that means that' "liberation of inherent possibilities" no longer adequately expresses the historical alternatives' *(ibid.,* 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' *(ibid., 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 to consideration of the leading part if one wishes to see what paths are likely to be taken. His judgement 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. 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 times" ... Recently, however, the compliant (conforming) pattern emphasized by Fromm, Ríesman and others began to give way to the secondary type, the hysteria with negativistic defences. 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.' (Angyal, 1966, p. 154; our inserts.)

He sees the phenomena as being at the social level of the beatnik as 'a protest against the levelling tendency of social conformation which threatens the extinction of spontaneous individuality' *(ibid.,* 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 cope better 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, Bretons, the urban poor or the rural communities), and widening the gulf between the cultures of advanced and underdeveloped 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 terms the transverse dimension of system organization and what we prefer to term the properties of co-ordination and regulation. Essentially, dissociation would entail that the possible outcomes of the behaviours of others are less frequently taken into account as a starting condition for one's own behaviour, 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 to 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 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 U.S.A. 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 sees dissociation as being at least as important a technique in modem 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:

(a) they are mutually facilitating defences, not mutually exclusive;

(b) 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;

(c) they all tend to sap the energies that are available to and can be mobilized by the larger systems and otherwise to 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 underdeveloped 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 modem industrial nations is so obviously undermined by these processes that they lack 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 4 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 2 and 3. 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 or 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 has pointed out, they have the conceptual character of `power fields' and act as guides to behaviour.

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, p. 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, third, `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 both 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, pp. 327-39). Short of this, something can be done by searching from amongst existing values for some that may be appropriate. This can only be an ad hoc solution fraught with dangers. If it is necessary to beat a partial retreat from the overwhelming uncertainties of a turbulent field, then 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.[6]

If these questions we 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 1990's. In our view this is not the case—the three problems seem to be soluble by a single strategy.

The 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 mould 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 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 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 a choice in basic organizational design is 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 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

[6] 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 behaviour, fads and fashions or otherwise as irrational group behaviour. These sorts of blind ground movements would seem to be more salient in the turbulent fields.

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 or 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 costs of the parts. The human body is the classic example of this type of system although 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 organization, we have a genuine choice between these design principles. When the cost of the parts is low (in our context, the cost of individual life), 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 reproductíve rates and investment rates could reverse this. There is, however, a more general principle that favours 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 adapted, there are strong reasons for reducing the correlation of parts (e.g. anti-unionism of Adler on the management of concentration camps). The second factor also happens to be our basic concern—environ-mental 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 is or not, we will be better able to judge by the end of the next thirty 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 judgement 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 U.S., what has been termed `systems management', and the programmes being pursued in the U.K. 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 organizations 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:

1. '1. 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;
2. A more systematic advance comparison of means by criteria derived from the ends selected;
3. 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;
4. 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;
5. An emphasis on information, prediction and persuasion, rather than on coercive or authoritarian power, as the main agents of co-ordinating the separate elements of an effort;
6. 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, p. 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, p. 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:

(a) Decision making and judgement cannot be reduced to the narrow band of formal logical structures to which computers are restricted (Cowan, Dreyfus).

(b) `Optímízatíon 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.)

(c) 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 apart, 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.'

Systems management and the U.K.-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 3 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 co-operation 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 control 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 2) or capabilities (as in Type 3). The strategic objective has to be formulated in terms of institutionalization. As Selznick 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' (1957, p. 27); `... the executive becomes a statesman as he makes the transition from administrative management to institutional leadership' (1957, 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. In so far as institutionalization becomes a prerequisite for stability, then 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. Hirschman 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 co-ordination 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.*

Summary

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 the 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.

V. CONCLUSION

Time 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: (a) growth in G.N.P.; (b) growth in productivity; (c) growth in range of what can be produced; (d) increasing indirectness of human contribution to the productive process.

Among the social and human effects that need to be considered are: (a) the changes in the salience of human affects as distress becomes less dominant. Cultural differences should be considerable; (b) the shift in balance between the portion of life given over to work and leisure; (c) the shift in balance between the Man—Nature, Man—Man relations.

In the field of information technology the significant changes are: (a) the shift in balance of costs between communication and transportation; (b) 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; (c) 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 and Kuhn 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 thirty years. Two main sets of conditions have attracted attention: (a) qualitative and quantitative changes in the population inputs to the world society; (b) 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 moulded 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.

REFERENCES[7]

ACKOFF, R. L. (1949). On a science of ethics. *Philos. & Phenomenological Research* 9, 663-72.

ACKOFF, R. L. (1966). The meaning of strategic planning. *McKinsey Qtly.* 3, 48-62.

ALMOND, G. & COLEMAN, J. (Eds.) (1960). *The Politics of the developing areas.* Princeton: Princeton University Press.

ANGYAL, A. (1958). *Foundations for a science of personality.* Cambridge, Mass.: Harvard University Press.

ANGYAL, A. (1966). *Neurosis and treatment.* New York: Wiley.

ARENDT, H. (1958). *The human condition.* Chicago: University of Chicago Press; London: Cambridge University Press.

ASHBY, W. R. (1956). *Introduction to cybernetics.* London: Chapman & Hall.

ASHBY, W. R. (1960). *Design for a brain.* Second Edition. London: Chapman & Hall.

BARKER, R. G. *et al.* (1946). *Adjustment to physical handicap and illness.* New York: SSRC Bulletin 55.

BELL, D. (1965). Twelve modes of prediction. ln *Penguin Survey of the Social Sciences.* London: Penguin Books.

BRUMER, J. (1964). Presidential address. *J. Soc. Issues* **20,** 21-33.

CHEIN, I. (1944). The logic of prediction: some observations on Dr Sarbim's exposition. *Psycho!. Rev.* **52,** 175-9.

CHEIN, **I.** (1947). Towards a science of morality. *J. Soc. Psycho!.* **25,** 235-8. CHEIN, I. (1947). The genetic factor in a historical psychology. *J. Gen. Psychol.* **36,** 151-72.

CHURCHMAN, C. W. & ACKOFF, R. L. (1949). The democratization of philosophy. *Science & Society* **13,** 327-39.

CHURCHMAN, C. W. (1961). *Prediction and optimal decision.* New York: Prentice Hall.

CHURCHMAN, C. W. (1966). On the ethics of large-scale systems. U.C. Berkeley Space Sciences Laboratory, Paper 37.

COWAN, T. A. (1965). Non-rationality in decision theory. U.C. Berkeley Space Sciences Laboratory, Paper 36.

DEUTSCH, M. (1954). Field theory in social psychology, In Lindzey, G. (Ed.), *Handbook of social psychology,* Vol. **I,** Ch. 5. Cambridge, Mass.: Addison Wesley.

DREYFUS, H. L. (1965). *Alchemy and artificial intelligence.* Calif. Rand Corporation Paper 3244.

DRUCKER, P. F. (1957). *Landmarks of tomorrow.* New York: Harper.

EMERY, F. E. & TRIST, E. L. (1965). The causal texture of organizational environments. *Hum. Relat.* **18,** 21-32.

FERGUSSON, C. E. & PFOUTTS, R. W. (1962). Learning and expectations in dynamic duopoly behaviour. *Behan. Sci.* **7,** 223-37.

FRANKFORT, H. *et al.* (1949). *Before philosophy.* London: Pelican.

GIBSON, Q. (1960). *The logic of social inquiry.* London: Routledge & Kegan Paul.

GOLDSCHMIDT, W. (1960). *Understanding human society.* London: Routledge & Kegan Paul.

HEGEL, C. W. F. (1949). *Phenomenology of the mind.* London: Allen & Unwin.

HIRSCHMAN, A. O. & LINDBLOM, C. E. (1962). Economic development, research and development, policy making: some convergent views. *Behan. Sci.* **7,** 211-22.

KUHN, T. S. (1962). *The structure of scientific revolutions.* Chicago: University of Chicago Press (Phoenix Books).

LEWIN, K. (1936). *A dynamic theory of personality.* New York: McGraw Hill.

[7] Only those items are listed that are referred to in the text.

LEWIN, K. (1951). Defining the field at a given time. Ch. **III** *in Field theory in Social Sciences.* New York: McGraw Hill.
MARCUSE, H. (1956). *Eros and civilization.* London: Routledge & Kegan Paul.
MARCUSE, H. (1964). *One dimensional man.* London: Routledge & Kegan Paul.
McLUHAN, M. (1964). *Understanding media.* London: Routledge & Kegan Paul.
NEUMANN, E. (1966). *Art and the creative unconscious.* New York: Harper Torchbooks.
PEPPER, S. C. (1961). *World hypotheses.* University of California Press.
PRICE, D. (1961). *Science since Babylon.* Yale University Press.
SCHUTZENBERGER, M. P. (1954). A tentative classification of goal-seeking behaviours. *J. Ment. Sci.* **100,** 97-102.
SELZNICK, P. (1957). *Leadership in administration.* New York: Row Peterson.
SIMON, H. A. (1956). Rational choice and the structure of the environment. *Psychol. Rev.* **63,** 129-38.
SOMMERHOFF, G. (1950). *Analytical biology.* London: Oxford University Press.
STONE, P. **J.** *et al.* (1966). The general inquirer. Cambridge, Mass.: the M.I.T. Press.
TODA, M. (1962). The design of a fungus-eater: a model of human behaviour in an unsophisticated environment. *Behay. Sci. 7,* 164-83.
TOLMAN, E. C. & BRUNSWIK, E. (1935). The organism and the causal texture of the environment. *Psycho!. Rev.* **42,** 43-77.
TOMKINS, S. S. (1962). *Imagery, affect and consciousness.* Vol. I. New York: Springer.
WAY, M. (1967). The road to 1977. *Fortune,* January 1967.

BIOGRAPHICAL NOTE

Emery, F. E. (1967). "The Next Thirty Years: Concepts, Methods and Anticipations." Human Relations **20**(3): 199-237.