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The Second Design Principle

Participation and the Democratization of Work (1)

Two Basic Organizational Designs

In choosing their Organizational designs, people do not confront an infinite range of choice. Far from it. If their organizations are to be purposive, they have to be adaptive over a wide range of evolving circumstances. The alternative is some sort of servomechanism with a fixed repertoire of responses, capable of surviving only within a very narrow range of foreseeable conditions - To achieve wide adaptiveness redundancy has to be built into the system. This is an important property, as with each arithmetic increase in redundancy the reliability of the system tends to increase exponentially (Pierce, 1964).

> There are two basic ways that redundancy can be built in:
>
> By adding redundant parts to the system. Each part is replaceable; as and when one part fails, another takes over.
>
> By adding redundant functions to the parts. At any one time some of the functions of any part will be redundant to the role it is playing at the time; as and when a part fails in the function it is performing, other parts can assume the function; so long as a part retains any of its functional capabilities (i.e., functional relative to system requirements) it is of some value to the system.

The first design of redundant parts has been described by Mumford (1967) as the megamachine, and he has traced its long Asian history and more recent Western debut. Feibleman and Friend (1969) characterized the logical properties of the first design as *subjective seriality* in which "the governing relation is asymmetrical dependence. The sharing of parts is necessary to one of the parts but not to both" (p.36). The second design is characterized by them as complementary seriality, in which "the governing relation is *symmetrical* dependence. The sharing of parts is necessary to both of the parts. Neither part can survive separation" (p.36), "....parts are on a parity with respect to their relations with others parts, and each is dependent upon the other" (P.38). It is of interest that their analysis of the *structure and function of organization* revealed no more than just these two basic designs at the level of purposeful systems

(1) A reproduction of part of Chapter 4 Of Futures We Are In. Leiden: Martinus Niihoff, 1976.

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If redundancy is sought by having redundant parts, then there must be special control mechanisms (specialized parts) to detennine which parts are failing and have to be rendered redundant and which have to be activated for any Particular response to be adaptive. If the control is to be reliable it, too, must have redundant parts, and hence the question of yet another level of control emerges. The more difficult it becomes to detennine the failure of dependent parts in time to make adaptive replacements, the more the levels of control tend to Proliferate (compare the many levels of control to be found in an army or an oil refinery with the few that are found necessary in a car assembly plant).

One can expect a bias toward choosing the first design if

- the costs of the individual parts are low,
- there are long lead times available for the organization to learn new modes of response.

Certainly, once this first basic design is chosen, efforts will be made to keep down the cost of the individual part by sustaining a pool of unemployed, obtaining access to pools of poor and preferably dispossessed peasantry (e.g., the Gastarbeiter of Germany and Australia's postwar migration scheme) or specializing and standardizing the function of the individual parts to minimize costs of training and retraining (Taylorism).

Regarding the second source of bias toward the megamachine it is worth starting our considerations from the often made observation that this is a great way to run a railway or an army:

> There are irrefutable advantages to this kind of Organisation. Discipline is good, errors in routine procedures rarely go unchecked, and if the very top man is an exceedingly able executive he can usually make the whole Organisation jump to his command very quickly. It usually takes a long time to build, and it is at its most successful when the function of the Organisation is to control a very large number of people all doing more or less the same thing. It is the way most armies are organised platoon, company, battalion, brigade, division, corps, army- and if you want to make a million men advance or retreat at a few hours notice it is hard to think of a better system. (Jay, 1970:73)

Armies fight for short periods of their life under conditions of great uncertainty, great turbulence. Hence it is hard to reconcile Jay's enthusiasm for Organizing armies in this way with the contention that they are only adaptive when allowed "long lead times for learning." It is also hard to reconcile with the organizational logic that underlies the contention that *this type of system is inherently error-amplifying*. The governing principle of asymmetrical depen-

dence means that errors will leak in from the environment like water from a sieve. It is in no one's interest to be rendered redundant because of association with an error or failure. Even without that psychological weakness, the relation of asymmetrical dependence will ensure that the flow upward of information from one level of control to the next will take the following form:

$$T = (I - F)_n$$

If there were five good people reporting to a manager, people who were truthful (T) eight times out of ten, i.e.,

$$T = (1.0 - 0.2)_5$$

then there would be, on average, only one in three occasions when it could be said that this must be sound advice because they are unanimous. However, the same principle applies at all levels. If this manager and five others at the same level have been well chosen and hence are right nine times out of ten, then the chances of their superior getting such a good straight message through them from the level below are, by the same arithmetic, 0.002____ twice in a thousand such communications! (Beer, 1972). This very disturbing property of error-amplification arises in a system based on asymmetrical dependence because each manager must seek to maintain the asymmetrical dependence of subordinates. Hence managers will seek to ensure that their subordinates each give independent judgments and that they cannot go into collusion to influence decisions. But the mathematics of this are inexorable. The more this aim of controlling subordinates is achieved, the greater the error; even if the subordinates are not psychologically motivated to protect themselves by hiding their errors.

Given this inherent weakness, a major part of the effort of utilizing cheap dependent labor by this first design has gone into control systems that will minimize the weakness. Thus Jay, in the above quote, says that in these types of organizations discipline is usually good. I suggest that in these types of organizations one usually finds good discipline not because they naturally create good discipline but because they cannot function without imposing good discipline. That they cannot function unless their individual parts are not only replaceable but are also so threatened by punishment or withdrawal of rewards that they will behave in a Preprogrammed manner regardless of the evidence of their senses or their common sense. Lewis Mumford has documented the vicious practices of torture and maiming that were introduced with the earliest emergence of the megamachine. Poet laureate Masefield has documented the inhuman disciplinary practices of the Royal Navy up to the age of steam. Taylor and his contemporaries simply devised new "sticks and carrots" so that this organizational design could function within societies like the United States of America where the Constitution forbids "cruel and unusual punishment." There was no change in the aim; the aim remained that of blocking the holes of

the sieve, preventing error getting into the system. By elaborate preprogramming of the parts at the work face and of the control systems, expected contingencies could be met and failure of a part quickly identified. As Jay (1970) observed, such an organization "usually takes a long time to build." Standard operating procedures, rules and regulations and training manuals have to be multiplied to meet the ever emerging contingencies. They can rarely be wiped off the book because there can rarely be agreement among the control agencies that such contingencies might not occur again. New contingencies are slow to be recognized because of the possibility that they are inventions of subordinates trying to cover up mistakes that might lead to their redundancy.

I can now summarize the learning properties of an organizational design based on redundant parts. There is an optimal amount of error that is necessary for learning by any type of system. The error-amplifying characteristic of this type of system threatens to swamp it with so much error that it is reduced to the response strategy of an addictive gambler (or a cat in a Thorndike puzzle box), i.e., to stick rigidly to a system, right or wrong. The major active response to error-even those errors that are necessary for learning-is to prevent it from getting into the system and to eliminate or send to limbo any part that appears to be associated with the intake of error or its perpetuation. With this kind of learning where is the adaptiveness?

Jay is undoubtedly correct in stating that with this sort of system it is hard to think of a better one "if you want to make a million men advance or retreat at a few hours notice. " It is possible, with months of work, to preprograrn so many to start to advance or to start to retreat within hours of the starter's gun. Adaptive control, however, more or less finishes after that point, unless one has preprogrammed reserve forces to be fed into the subsequent action. Field Marshal Haig released a vast preprogrammed army across the front at the Somme at 7:30 a.m. on July 1, 1916. At 3.00 p.m. that day, he had precious little idea of where his many divisions were or what they were doing, although none of them had gone more than a mile or so from where they were at dawn. They had disappeared into the fog of war. This sort of information flow hardly augurs well for adaptability. When the Passchendaele offensive opened on July 31, 1917, there was little evidence that learning had occurred in the previous year. As I said earlier, this type of organization needs a long lead time for learning. So long, indeed, that Liddell-Hart (1944) said that armies normally prepare themselves to fight their last war.

The criterion of survival can be somewhat misleading in circumstances where the competing parties are all organized on the first design principle. The big battalions win the wars but lose the peace because of the price they pay for victory.

It should be clear by now that choice of the design principle of redundant

parts predetermines the ideals that such a society will pursue.(2) Person will be set against person in the asymmetrical master/servant relation to ensure that their collectivized labor will produce Plenty in the form of pyramids, sky-scrapers or other such indicators of the greatness of their masters. Better ways to ensure increased productivity will evolve and, when evolved, be widely adopted. But, more and more, people will doubt whether these means of increasing plenty are reconcilable with the quality of human life. Truth will be a precious commodity in an environment where it decays so quickly in transmission to the key decision makers. Every effort will be made to arrive at better ways to establish the truth and to disseminate such methods when they emerge. The good will be an ideal of high standing, as befits an ideal. Science becomes the new fountain of wisdom and becomes increasingly mistrusted in societies based on this first design principle. The concept of the "good Samaritan" evolves into the Welfare State. Good deeds are increasingly done by numbers, and the poor, deserving or not, wonder whether they are not just replaceable ciphers in a code that they cannot break.

The ideal of *Beauty*, an ideal which should move all people, suffers a particularly cruel fate in systems designed on this principle. The ideal becomes embodied in that which is biggest, whitest and most durable, and capable of demolition tomorrow. The criteria of beauty-those which attract patronage --- are grandeur and being esoteric. Both place beauty beyond what might be aspired to by a servant in a system based on master/servant relations, i.e., subjective seriality. The alternative design based on redundant functions (multifunctional parts) has been the favored design in the Western cultural tradition, if not always in practice. It also appears to have been the general preference in human societies up to the point where swidden agriculture gave way to societies based primarily on sedentary cultivation and the use of metals.

The basic conditions favoring the alternative design are

- The individual parts are costly (e.g., well educated or skilled) or highly valued.
- Adaptation has to be to a highly variable, complexly intercorrelated environment, i.e., one in which a great deal of potential error is present and is not randomized.

In contrast to the first design, this one is essentially *error attenuating*.

(2) The following three criteria for identifying an ideal are taken from Churchman and Ackoff (1949)

The system, by its own functioning, tends to suppress errors that come into the system. The formula given by Beer is

$$T = (I - F_n)$$

Thus, if, as in the first example, five people reporting to a manager are each usually right in their judgment eight times out of ten, then

$$T = (1.0 - (0.2)_5)$$

Only about three times in 10,000 will they unanimously give him the wrong advice. The relation of symmetrical dependence means that they will check with each other as to the quality of the advice they were thinking of giving. We have assumed that they are no better as individual managers than those in the first example and no better than each other. Each is assumed fallible on two occasions out of ten. They will not, however, be fallible in the same ways and hence by working via this second design they help in suppressing each other's tendency to err.

With this quality a great deal of error can be accepted into the system and learned from. Rigid barriers of standing operating procedures and manuals do not have to be defensively manned as in the first design. Error is coped with by continuous leaming and rearrangement of functions, not by prescription and rearrangement of parts. In this system advantage can be taken of the principle that the total sum of error in the system is equivalent to the square root of the sum of the square of the erTors in each part. Attention can be directed to the weakest link and not to the specialized controlling parts as required in the first system. A further distinction between the two designs arises when the sources of effor in the environment are to some extent correlated: "it never rains but it pours." The first design is at its best when the sources of error are independent and only randomly occur together. Where this is not naturally the case, special efforts are devoted to approximate this condition, e.g., keeping extemal relations in special compartments and being very secretive about what is going on in those compartments. The second design learns improved adaptation by exposing itself to the difficulties arising from these extemal interdependencies.

A striking difference between the two systems occurs in the switching mechanisms. In the first design the critical decision is switching some parts to redundancy and activating others. The individual parts are probably not keen to be rendered redundant and not even very enthusiastic about being activated. These decisions are for the special control parts and it is ir-relevant to their function whether the parts know why they are switched. In fact, anything that psychologically separates the special control parts from the others would help to ensure that Proper decision rules are followed and are not obfuscated by merely human considerations. In the second design, with its governing princi-

pie of symmetrical dependency, the switching is governed by the conditions of mutual help. The problem is that all parts, or enough parts, need to be alert and willing to bring their unused capabilities into action when the shared task demands it. Without considerable sharing of values and objectives, the potential Of this design may not be realized, which may be one reason why Taylor (1911) turned to revamping the first design for the utilization of the multinational work force Pouring into United States industry in his day.

One other Property of these systems was noted by Feibleman and Friend (1969) and has frequently been observed. Organizations based on redundancy Of Parts constantly strive to accumulate a superfluity of parts to ensure that at any one time they have more parts than they actually need for what they are doing. These reserves of duplicated parts are essential to ordinary day-to-day operation and are the major insurance against the unexpected. This superfluity of manning is sought at all levels except the very top. By contrast, organizations based on redundancy of functions (capabilities) find their optimal level at a point where undermanning stretches their joint resources and frequently challenges them to reallocate functions.

In choosing this second design for their organizations, People are implicitly making choices among ideals-for homonomy rather than self-seeking, self-serving autonomous strivings; for mutual help and nurturance rather than their own survival in the system; for inclusion of the criterion of humaneness along with the usual decision rules of effectiveness and cfficiency. it may be difficult to grasp, but the emergence of a rich complex field of directive correlations within such organizations would even make them seem to be more beautiful settings to be in. **(3)**

I do not think that we can hope actively to adapt to turbulent environments without restructuring major institutions along the lines of the second design Principle, redundancy of the functions of individual Parts. As noted above, bureaucracies are based on the first Principle and the individual is an instrument of the system . *An instrumentfunctions as a lower order system than the system that uses it* (Ackoff and Emery, 1972:31-32). Quite simply, using an analogy from mathematical statistics, an instrument is always going to operate with one degree of freedom less than the system using it. Thus, although a social System is a Purposeful system whose members are Purposeful, there is a constant

(3) In *Logic of the Living Brain* (1972) Sommerhoff tried to identify models that would explain the uniquely adaptive characteristics of that organ and still dojustice to the knowledge we have of its structure and functioning. He was led to reject the design based on redundant parts and to Postulate two variants based on redundant functions. These two variants closely parallel the two discussed by Emery and Emery (1973).

tendency toward *increasing or decreasing variety* in the range and level of the

behavior of the individual members. In systems based on the first principle, the tendency will be toward *variety decreasing*; the range of purposeful behavior will be restricted and increasingly behavior will be at a lower level of multi-goal-seeking or goal-seeking behavior. The assembly line has been the epitome of this process but the same phenomenon appears in the bureaucratic organization of even scientific and engineering work (Bums and Stalker, 1961).

Systems designed on the second principle will tend to be *variety increasing*; to maintain and extend the multifunctionality of their members, they will seek to extend the range of their purposeful behavior and increase the opportunities and support for ideal-seeking behavior. That is, such systems will be founded on the assumption that they are best served by serving as an instrument to the potentially higher system capabilities of their individual members.

Democratization of Work

As mentioned earlier, the choice of organizational design is simply twofold. In a turbulent environment only the choice of the second principle is potentially adaptive. Only organizations based on this principle can be expected to develop and nurture ideal-seeking individuals. Only a sufficiency of ideal-seeking individuals can offer the choice of bringing turbulent social fields under control (Winnicott, 1950).

Work, and the organization of people around work, is the "leading part" of Western societies. What happens at work tends to determine what can and does happen in the areas of family life, education, leisure, etc. This is not to deny that these other areas of living have their own history and their own self-determining characteristics.

Bureaucratization of work in Western society has been a major contributor to the present social turbulence both in negating Western values and in creating monolithic organizations whose decisions could set off autochthonous processes in their environments.

It might seem that people could meet part of their present needs by simply debureaucratizing their organizations. This is not a viable solution as is well demonstrated by the anemic failure of such movements to change the nature of industrial life. Examples are the human relations movement of the 1940s and 1950s and job enrichment of the 1960s. The efficiency of an organization can only be reduced if its various parts or aspects are designed according to contradictory design principles. There must be interfaces between such aspects or parts, and at these interfaces the conflict in principles undermines coordination. In discussing how the U.S. aerospace industry was forced by environmental pressures toward the second design principle in their research and development work but were, overall, hung up on the first principle, Kingdon

(1973: 18) observes:

> Of course these two principles, or organizational purposes, may not always be in accord with each other. In fact, it is more nearly the case that the two are in conflict with one another and that conflict resolution is a necessary part of the matrix organizational form. (cf. Bums and Stalker, 1961)

The target that people will increasingly set for themselves is not just de-bureaucratization but the positive target of redesigning their work organizations on the second principle, the target of democratizing work.

The movement to do just this can be clearly traced from the first experiment in the Bolsover coal mine in 1952 (Trist et al., 1963/Vol. 11) through Emery and Emery (1973/VOI. 11) and Davis (1971) to the work of O'Toole (1974) in relation to the Report of a Special Task Force (1973) to the Secretary of Health, Education and Welfare of the United States on Work *in America*.

Before examining in detail what is entailed in the notion of democratization of work, let us note two general features.

First, the essential change in the design of work organizations is that the "building block" is changed from the unit of one worker/one job under direct supervisory control to the semiautonomous group of people carrying responsibility for a unitary task. In this latter type of organization, the interface between the individual and the organization, no matter how large, is the face-to-face group.

The success that has arisen from reorganizing work around small, relatively autonomous groups would seem to follow from the shift in instrumentality, When the small social system becomes an instrument for its members there is a tendency for it to become *variety increasing*; they are able to pursue not only production goals but also purposes and even ideals that pertain to themselves---the ideals of homonomy, nurturance, humanity and beauty (see Ackoff and Emery, 1972, for these key ideals). This possibility emerges only when they have the responsibility for managing how they will relate to each other and what responsibilities they will assume toward each other.

Second, the starting points of this movement give some explanation of why I think it will become the dominant trend in Western industry. The first moves were in the science-based industries, particularly the process industries. The very nature of their technologies challenged the rationality of bureaucratic organization. Only in the 1970s did the assembly line become a key focus. This time it came as a revulsion against the tool-like use of human beings. This general revulsion has already spread to challenge most forms of bureaucratized work, mental as well as manual, professional as well as nonprofessional. The first and deepest commitments to change came from Scandinavia. I believe that

it was easier to start there not only because of the socially advanced nature of Norwegian and Swedish society, but also because they were smallish, culturally homogeneous societies. Their industrialization had started late and had neither created deep divisive class hatreds nor removed them far from their preindustrial culture. it is probably only by their example that they have been given that the other larger countries have felt able to grasp the nettle.

Matrix Organizations

The vertically and horizontally monopolistic organization is an adaptive product of the disturbed reactive environment. I do not believe that there is any way in which such structures can adapt as individuals do to turbulent environments (despite Terrebury, 1968). They cannot themselves be ideal-seeking, and hence their chances for survival are dependent upon creating organizational environments within which enough of their members will be ideal-seeking. These organizational environments cannot be created by individual organizations.

I see two organizational tendencies emerging as potentially effective responses to turbulence: one with regard to relations between organizations, including those between national parts of the so-called multinationals; the other with regard to "corporate planning."

Whereas disturbed, reactive environments require one or other form of accommodation between similar but competitive organizations (whose fates are to a degree negatively correlated), turbulent environments require some relationship between dissimilar organizations whose fates are basically positively correlated; that is, relationships that will maximize cooperation while still recognizing that no one organization could take over the role of the other. I am 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 for evolution of ground rules, another independent but related aspect must provide for broader social sanctioning. Insofar as the sanctioning processes can be concretized in an institutional form, it should be possible for the component organizations to retain an effective degree of autonomy and to engage in effective joint search for the ground rules. Within the domain covered by such a matrix, there need to be further sanctioning processes to control the diffusion of values throughout the member organizations. Outstanding examples of such organizational matrices are those that have emerged to cover international communication.

It should be noted that in referring to the matrix type of organizations as one possible way of coping with turbulent fields, we are not suggesting that the higher level of sanctioning can be given 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 stability by helping to transform turbulent environments into the kinds of environments that I have described as clustered-placid (Type 2) and disturbed-reactive (Type 3). Within the environments thus created, an organization could hope to achieve stability through its strategies and tactics. However, the transformed environments can no longer be described 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 (1957) states in his analysis of the leadership of modem American corporations,

> the default of leadership shows itself in an acute form when organizational achievement or survival is confounded with institutional success.....the executive becomes a statesman as he makes the transition from administrative management to institutional leadership.

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 value concerning the protection and development of those resources becomes an intrinsic part of the framework of management objectives and a basis for matrix organizations (Hill, 1971 /Hill and Emery, Vol. II).

It is of interest that May's (1972) mathematical modeling of large complex systems suggested a similar strategy for avoiding instability. Referring to Gardner and Ashby's (1970) computations, he notes that

> 12-species communities with 15 percent connectance have probability essentially zero of being stable, whereas if the interactions be organized into three separate 4 X 4 blocks of 4-species communities, each with a consequent 45 percent connectance, the "organized" 12-species models will be stable with probability 34 percent....Such examples suggest that our model multi-species communities, for given average interaction strength and web connectance, will do better if the interactions tend to be arranged in "blocks" again a feature observed in many natural ecosystems. (1972:414)

For passively adaptive systems (Principle i), this would mean no more than the strategy of segmentation discussed earlier. For actively adaptive systems (Principle 2), we are suggesting that matrix type organizations will, like the logic of cluster sampling, maximize the variance within their particular matrices and hence lessen the variance and difficulties of the ends they agree upon as being related to other such matrices. This is opposed to the logic of strata sampling and the strategy of segmentation, which seem to minimize the variance within strata and consequently maximize that between them. When one considers the interpenetration of sources of variance in a turbulent social field, it is not

surprising that the logic of matrix organization so closely approximates that of cluster sampling.

Adaptive Planning

The processes of strategic planning are also modified. Insofar as institutionalization becomes a prerequisite for stability, the setting of subordinate goals will necessitate a bias toward those goals that are in character with the organization and a selecting of the goal paths that offer a maximum convergence about ideals held in common with other parties (Simmonds, 1975).

I have already referred to the technology of planning that emerged in the disturbed-reactive environment (Type 3). 1 think that this style of planning for optimization will be not just ineffective but maladaptive: the pattern of active maladaption response described as "synoptic idealism." Ackoff (1970) has identified the emerging pattern of "adaptive planning."

This notion of active planning may be compared with Lindblom and Hirschman's "disjointed incrementalism." The convergence is not surprising, as disjointed incrementalism was identified as the type of planning required in the face of gross complexity, future uncertainty and the difficulty in mobilizing human potential for implementation. At the same time, active adaptive planning lays a stress on the conscious identification of shared values or shared perspectives, past or present, that is absent from disjointed incrementalism. Of the io characteristics associated with disjointed incrementalism (Hirschman and Lindblom, 1969:358-59) at least four---1 2 3 and 8---are essentially in the satisficing mode. As a result, this way runs the risk of degenerating into the passive adaptation of parish pump politics. Active adaptation requires some sense of desirable futures as a deliberate step to avoid entrapment in the past.

Notions of planning are so central to current concepts of how society will deal with its future that I think the whole concept needs to be rethought. It is not simply a matter of "corporate planning" but of planning for cities, leisure, social welfare, economic growth, etc. The extended treatment by Hirschman and Lindblom seems faulty; that of Ackoff was only meant to suggest what is needed.

The decision to plan implies some commitment to bring into being a state of affairs that does not presently exist and is not expected to occur naturally within the desired time. The kind of planning we expect to emerge is that which will produce plans that will *probably* come to pass. It is not enough to have one of the optimizer's *feasible* plans. We need plans which will probably come to pass because the people involved in or served by their implementation want them to succeed. The hard-won agreements that the optimizer has for the initial, hard-nosed definition of objectives are no guarantee of active support when it comes

to implementation. On the contrary, I think that these agreements carry within them the seed of subsequent subversion (as insistence on doctrinal purity in other fields of human endeavor carry the seeds of deviationism and heresy). Nor can the optimizer carry the day with his arrays of fact, statistical forecasts and impartial, objective calculations of the cost-effectiveness of alternative paths. These things do carry weight and may silence overt opposition, but, where there is a feeling that justice is not being done, facts will not convince otherwise. One has only to recall the instances where the nagging doubts of one individual have eventually led to a murder case being reopened. The apparent dilemma in "modem" *planning is how does the expert make a contribution of planning without alienating people?* This almost has the making of a paradox for Social planners: the more knowledge experts accumulate, the greater the gap in understanding between them and the people and the less likely they are to go along with their plans for implementation or, to put it otherwise, the more we know, the less we can do. In his own context Mao posed it as the problem of "Red or Expert."

I do not think we can suggest any way to resolve this dilemma unless we confront, simultaneously, another dilemma. Planning to produce a new state of affairs seems to presuppose that we know where we want to go, we know where we are now, we know what paths will take us from here to there and we know what means we have for traversing those paths. For turbulent social environments this presumes an awful lot of knowledge. When the social setting and the human instruments of change are both changing, the knowledge we have today is increasingly less relevant. The dilemma is *how can we expect to improve our planning in the face of relatively decreasing knowledge?* Again, we come close to a paradox: the more society changes, the more we need to be able to plan but the less we have the knowledge with which to plan.

The common element in the two dilemmas is the notion of "expert knowledge." If we are to resolve these dilemmas, we will have to ask whether what we understand by expert knowledge is the kind of knowledge required for planning social changes in a changing society. I think there is room for doubt on at least three scores.

First, decision makers mistake the nature of the situations for which they are seeking a planning solution. Even the optimizers seem to think they are engaged in problem-solving. They think they know the problem and simply have to search through existing knowledge in order to come up with a range of probable solutions which they can then compare. Social planning has, however, come to be more like puzzle-solving than problem-solving. Each situation is so complex and unpredictable that one has to learn each unique set of steps that leads to a solution. In problem-solving it is typical to have the insightful "eureka" experience when a solution suddenly becomes apparent and after that it is just a matter of work to put the pieces together. In a puzzle

one does not have this experience. The relation between the pieces is very much a matter of local determination. One can determine what is required for the piece to fit but, until that piece is found one has very little idea of what is going to be required of the piece after that. Previous experience or training cannot enrich the repertoire of solutions; at best they may help a person "learn how to learn." This does not sound like our expert. The expert is usually chock-a-block full of knowledge about what solutions will solve a given class of problem.

Not surpnsingly, the Oxford English Dictionary (OED) helps to clarify the distinction I have tried to make. A problem is literally "a thing thrown or put forward - " The implication is that when faced with a problem we are also given a knowledge from whence it arose, was thrown from or put forward by. This implication is enhanced when the OED states that, in logic, "a problem can be that of arriving at the conclusion in a syllogism"; in geometry, "a proposition in which something (further) is required to be done"; in physics and mathematics, "a question or inquiry which *starting from some given conditions* investigates some fact, result or law." Chess "problems" are similarly defined by the OED as deriving from a given arrangement of pieces and set of rules. Beyond this, the OED does indicate that the word was once upon a time used to indicate that something was puzzling, enigmatic, a riddle; their last quote for this usage is dated A.D. 1602.

A puzzle is not defined by the OED in terms of what is out there that indicates and may assist what the person does by way of producing a solution. A puzzle is defined as simply a state of mind-"the state of being puzzled or bewildered; bewilderment; confusion; perplexity how to act or decide." What is "out there" in the case of a puzzle is indicated by a discussion of Chinese puzzles. Essentially, it is a matter of a person being expected to achieve a result that seems impossible to achieve, e.g., "to remove a piece of string from an object without untying it." Interestingly, the word puzzle (unlike "problem") has also readily assumed the form of a verb, e.g., "to search in a bewildered or perplexed way; to fumble, grope for something; to get through by perplexed searching"; " to puzzle out: to make out by the exercise of ingenuity and patience."

Second, the experts in this field have tended to act on a faulty model of so-called rational decision making. They theorize and write as if decision making was explicable in terms of only two dimensions: probable efficiency of different paths and relative value of the outcomes. Another dimension is necessary (Heider, 1946; Jordan, 1968; Ackoff and Emery, 1972). This other dimension is the probability of choice and reflects the *intrinsic* value of a course of action to the chooser as distinct from its *extrinsic* or means/end value. This human dimension is reflected in the old folk wisdom of "better the devil you know," "furthest hills are greenest, a "bird in hand." The persistent and

pervasive role of these nonrational factors has been explicated by Heider (1946) and unwittingly demonstrated in the "uncooperativeness" of humans in the recent rash of experimental studies of decision making. Similarly, established organizations show their own style in nonrational preference for ways of acting, particularly those that have had a special significance in their past, e.g., Rolls-Royce.

Third, people have tended to assume that what we need to know are more and more facts, when what is needed is knowledge of human ideals. This had come up very strongly with so-called enlightened operations researchers. Faced with the sorts of difficulties outlined above, they have sought for yet more knowledge: knowledge about people's motivations and how they can be managed to bring about predictable changes. I suggest that they are not about to get this knowledge from the social sciences (despite the pretensions of some social scientists) and that, even if they did, they would still be in a puzzle situation. The situational features to which the people respond would still be emerging in unpredictable ways. Where people are expected to go from A to B in ways that can be determined only as they proceed, it becomes more important that they must have a bit more knowledge about some of the paths; they must themselves be able to learn so that they can evaluate.

If one were to take seriously these strictures, the role of the planners would be no longer that of the experts tiding with the powers that be. Instead the planning functions would be seen to involve:

- Conducting some search process whereby the main parties to the proposed change can clearly identify and agree about the ideals the change is supposed to serve and the kinds of paths most in character with them.
- Designing a change process that will enable relevant learning to take place at rates appropriate to the demands of time-this being the time within which change must occur to avoid intolerable costs of not changing and the time by which decisions need to be made if adequate resources are to be mobilized.
- Devising social mechanisms for participation whereby the choice of paths will reflect the intrinsic value of these paths for those who will have to traverse them.

There are many considerations that lead one to regard identification of ideals as the first requirement for planning social change. Only ideals seem to have the necessary breadth and stretch in social space and time. Motivations, attitudes and social objectives may well change as planning and implementation proceed, but human ideals do not appear to change so rapidly. This is not to say that the relative weightings of the ideals might not change(5) but even here we tend to have storm warnings well before the shifts become socially relevant (e.g., the shifts in "the Protestant ethic" which have only now become broadly relevant but which were heralded many years ago by the Beat generation of

Kerouac). Similarly, only ideals seem to have the breadth of influence to encompass the range of contesting interests that can be expected in an area ripe for planned change. Ideals do not ordinarily have the same urgency in human affairs as motivations, but what they lack in this respect may be more than compensated for if their identification recenters a zero-sum conflict to pursuit of common interests.

Ideals have the further advantage that they are not esoteric. Certainly, social scientists can lay no claims to expertise in deciding these matters. If a planned change is supposed to serve certain ideals then the layperson can, and will, understand the criteria for judging the planning process before being confronted by the final, and possibly irreversible, outcome. That judgment may not extend to a learned appraisal of why things are going wrong or what action should be taken, but at least the alarm may be sounded in time for something useful to be done.

One special property of ideals needs to be noted because of the damage it does to the optimizer's claim to "planning excellence." The ideals that influence the behavior of people cannot be subsumed under a single ideal. Omnipotence, which is the one ideal that if achieved would permit the achievement of all other ideals, is only directly and single-mindedly pursued by infants and some sick, dependent people. Identification of the ideals involved in planned social change is almost certain to identify more than one noncomparable ideal, e.g., homonomy, nurturance, humanity and beauty. In such a context of multiple ideals, the skills of the optimizer cannot yield *the* plan. Hopefully they may still be utilized for tactical problems.

The other direction in which it was suggested that planning might change was toward designing ways of "learning to learn." Clearly, this cannot bejust a matter of pushing people in at the deep end. There must be some way of using accumulated experience and expertise to advantage.

In this mode of planning, the main cognitive searching shifts from search for means to search for ends. The search for means becomes less of a cognitive activity and more that of field experimentation. By such intervention one may get some sense of emerging possibilities and difficulties; what resources are actually needed; what resources, including human commitment and innovations, can be generated in the process of change; what shifts in emphases or changes in time taken are needed. In a situation of social change this kind of intervention can give us information for the choice of paths that we cannot expect

(5) 1n my experience differences in relative weighting have not been a serious obstacle to cooperation, providing valuation has been uniformly positive or negative.

to get from the massive cross-sectional surveys favored by the engineers-cum-urban planners. These surveys give us little more than history. By intervention, by pushing, tugging and tearing at the causal strands, we start to get some idea of the changing texture of the social field in which change is planned.

It will be noted that in this mode of planning, the "logical" order of planning activities becomes somewhat confused. Implementation and the selection of courses of action become inextricably involved with each other. Similarly, the allocation of resources becomes a means of encouraging the finding and selection of the best path(s). Resources do not automatically flow to those courses of action that, on previous cognitive analysis, have been determined to be "the best." Instead, resources flow toward those areas of implementation that show the most promise. Nor can one expect clear decision rules to decide what shows the most promise. The very notion of "showing promise" involves what is hoped for but not really expected. An initially disastrous experiment may be regarded as a place to channel resources if it shows that a lesson has been learned and local commitment created.

Planning in this mode must upset the optimizer. Where, it will be asked, is the control that will ensure that each part of the plan is enacted in a way and at a time that will ensure optimal use of resources? Where are the objective, impartial decision rules (and protective departmentalization of the planning function) that will ensure that Politically and personally motivated choices do not subvert the planned ends? These features are, in fact, absent and their absence could be critical to the optimizer's plans and planning. Our point is that in a rapidly changing society, the optimizing mode of Planning for social change is about as adaptive as a pig in water-the more the pig tries to swim, the more it slashes its own throat.

The optimizer tends to assume that plans are being prepared for a uninodal organization that will have the authority and power to command, through existing channels of coordination and control, that the plan be translated into reality. The new mode of planning assumes that there will be a multiplicity of nodes of power and that only a measure of cooperation between them will produce change in the desired direction. Consequently, in this new mode, the planners create the basis for control that emerges from a shared sense of ideals and present requirements and creates channels of communication and irritation appropriate to the shared needs for coordination.

In a very real sense, the most important product of this style of active adaptive planning is not the plan but the *community-in-planning*. The process creates the conditions for learning to learn, affirms the overriding significance of shared ideals and reduces the need for planning as a separate organizational activity. We can expect that this style of planning will generate an institutional form that will be as much part of our emerging societies as the campfire was to

the aborigines, namely, the "search conference" (M. Emery and F.E. Emery, 1978/Vol. 111). When new "matrix" formations seem necessary or old ones need to be discarded, we can expect those with potentially relevant operational responsibilities to come together for a brief span of days and nights to search jointly for the implications of sensed changes in their shared environments. Thus, for instance, union leaders and leaders of productive enterprises will seek such opportunities to share their understanding of how the "rules of the game" are changing. They will not relegate this task to "research officers"; they will not risk waiting to infer it from changes in each other's tactics and strategies; they will not attempt to deal with such matters in committee. In committee, it is necessary to stick with that which is significantly probable and trade from unchangeable comers. A good chairperson is one who rules out discussion of matters of mere possibility or low probability. Likewise, if a committee member is suspected of switching hats during a discussion, a good chairperson will insist on that member explicitly identifying the position he or she is taking.

In "search" even the improbable must be considered as a possible key to the future - Existing bodies of data and cur-rent notions of what is relevant can be no substitute for people's own sense of what is coming over the horizon. The reason for this great openness is simply that today's probabilities are not a sure guide to the future, but the future is likely to emerge from some of the possibilities that now exist. However, most people abhor such a degree of openness and are not likely to put up with it unless given ample time in which to search, freedom from the compulsion to arrive at explicit decisions and free-dorn from the outside interruptions of work and family.

It is this latter point that has led to the use of "social islands." The participants are brought together to form an isolated community for as many days and nights as seem necessary for their work. This temporary community not only reifies the overriding purposes but Provides psychological support to the individual. It represents a return to the older wisdom of the Persian tribes, reported by Herodotus, that no group decision reached at night was binding unless reaffirmed by daylight, and vice versa.

It may seem that an undue conservatism is built in by the stress on partici-pants including "the persons with the highest operational responsibilities." However, if the search process is to issue forth into a wide range of experimen-tal interventions, it must have the sanctioning of the existing powers and it must have the active support of those who control the operational units. If this Support is not forthcoming, the matter is one for a power solution, not a planning solution. One further matter offsets the conservative bias. In a rapidly changing social setting, the greatest resistances to planned change are likely to arise from fear of change rather than from vested interests. Vested interests can be identified, calculated and negotiated as part of the price of change. Fear of

change cannot; hence the great value of winning the hard core of professional leadership.

To identify the ideal goals that will be relevant to the planning process, the participants will tend to build up a shared picture of where the system has come from, as well as a shared picture of its likely futures. Beyond this, they will evolve guiding strategies for change that will bring others into the planning process and win their commitment to the ideal goals. As is stressed by Ackoff and by Schon, this means the emergence of broadly participative social systems that will "learn to learn" these systems will not just create mechanisms whereby they are fed knowledge accumulated by experts.

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