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The Causal Texture of Organizational Environments¹

Identification of the Problem

A main problem in the study of organizational change is that the environmental contexts in which organizations exist are themselves changing, at an increasing rate and towards increasing complexity. This point, in itself, scarcely needs laboring. Nevertheless, characteristics of organizational environments demand consideration for their own sake if there is to be an advancement of understanding in the behavioral sciences of a great deal that is taking place under the impact of technological change, especially at the present time. This paper is offered as a brief attempt to open up some of the problems, and stems from a belief that progress will be quicker if a certain extension can be made to current thinking about systems.

In a general way it may be said that to think in terms of systems seems the most appropriate conceptual response so far available when the phenomena under study--at any level and in any domain--display the character of being organized, and when understanding the nature of the interdependencies constitutes the research task. In the behavioral sciences, the first steps in building a systems theory were taken in connection with the analysis of internal processes in organisms, or organizations, when the parts had to be related to the whole. Examples include the organismic biology of Jennings, Cannon and Henderson; early Gestalt theory and its later derivatives such as balance theory; and the classical theories of social structure. Many of these problems could be represented in closed-system models. The next steps were

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taken when wholes had to be related to their environments. This led to open-system models.

A great deal of the thinking here has been influenced by cybernetics and information theory, though this has been used as much to extend the scope of closed-system as to improve the sophistication of open-system formulations. It was von Bertalanffy (1950) who, in terms of the general transport equation which he introduced, first fully disclosed the importance of openness or closedness to the environment as a means of distinguishing living organisms from inanimate objects. In contradistinction to physical objects, any living entity survives by importing into itself certain types of material from its environment, transforming these in accordance with its own system characteristics and exporting other types back into the environment. By this process the organism obtains the additional energy that renders it "negentropic;" it becomes capable of attaining stability in a time-independent steady state--a necessary condition of adaptability to environmental variance.

Such steady states are very different affairs from the equilibrium states described in classical physics, which have far too often been taken as models for representing biological and social transactions. Equilibrium states follow the second law of thermodynamics, so that no work can be done when equilibrium is reached, whereas the openness to the environment of a steady state maintains the capacity of the organism for work, without which adaptability--and hence survival--would be impossible.

Many corollaries follow as regards the properties of open systems, such as equifinality, growth through internal elaboration, self-regulation, constancy of direction with change of position, etc.--and by no means all of these have yet been worked out. Though Bertalanffy's formulation enables exchange processes between the organism, or organization, and elements in its environment to be dealt with in a new perspective, it does not deal at all with those processes in the environment itself which are among the determining conditions of the exchanges. To analyze these an additional concept is

needed--*the causal texture of the environment*--if we may reintroduce at a social level of analysis, a term suggested by Tolman and Brunswik (1935) and drawn from S.C. Pepper (1934).

With this addition, we may now state the following general proposition: that a comprehensive understanding of organizational behavior requires some knowledge of each member of the following set, where L indicates some potentially lawful connection, the suffix 1 refers to the organization and the suffix 2 to the environment:

$$L_{11}, \ L_{12}$$

$$L_{21}, \ L_{22}$$

L_{11} here refers to processes within the organization--the area of internal interdependencies; L_{12} and L_{21} to exchanges between the organization and its environment--the area of transactional interdependencies, from either direction; and L_{22} to processes through which parts of the environment become related to each other, i.e., its causal texture--the area of interdependencies that belong within the environment itself.

In considering environmental interdependencies, the first point to which we wish to draw attention is that the laws connecting parts of the environment to each other are often incommensurate with those connecting parts of the organization to each other, or even with those which govern the exchanges. It is not possible, for example, always to reduce organization-environment relations to the form of "being included in;" boundaries are also "break" points. As Barker and Wright (1949), following Lewin (1936), have pointed out in their analysis of the problem as it affects psychological ecology, we may lawfully connect the actions of a javelin thrower in sighting and throwing his weapon; but we cannot describe in the same concepts the course of the javelin as this is affected by variables lawfully linked by meteorological and other systems.

The Development of Environmental Connectedness

(Case 1)

A case history, taken from the industrial field, may serve to illustrate what is meant by the environment becoming organized at the social level. It will show how a greater degree of system-connectedness, of crucial relevance to the organization, may develop in the environment, which is yet not directly a function either of the organization's own characteristics or of its immediate relations. Both of these, of course, once again become crucial when the response of the organization to what has been happening is considered.

The company concerned was the foremost in its particular market in the food-canning industry in the UK and belonged to a large parent group. Its main product--a canned vegetable--had some 65 percent of this market, a situation which had been relatively stable since before the war. Believing it would continue to hold this position, the company persuaded the group board to invest several million pounds sterling in erecting a new, automated factory which, however, based its economies on an inbuilt rigidity--it was set up exclusively for the long runs expected from the traditional market.

The character of the environment, however, began to change while the factory was being built. A number of small canning firms appeared, not dealing with this product, nor indeed with others in the company's range, but with imported fruits. These firms arose because the last of the post-war controls had been removed from steel strip and tin and cheaper cans could now be obtained in any numbers--while at the same time a larger market was developing for imported fruits. This trade being seasonal, the firms were anxious to find a way of using their machinery and retaining their labor in winter. They became able to do so through a curious side-effect of the

development of quick-frozen foods, when the company's staple was produced by others in this form. The quick-freezing process demanded great constancy at the growing end. It was not possible to control this beyond a certain point, so that quite large crops unsuitable for quick freezing but suitable for canning became available--originally from another country (the United States) where a large market for quick-frozen foods had been established. These surplus crops had been sold at a very low price for animal feed. They were now imported by the small canners--at a better but still comparatively low price and additional cheap supplies soon began to be procurable from underdeveloped countries.

Before the introduction of the quick-freezing form, the company's own canned product--whose raw material had been specially grown at additional cost--had been the premier brand, superior to other varieties and charged at a higher price. But its position in the product spectrum now changed. With the increasing affluence of the society, more people were able to afford the quick-frozen form. Moreover, there was competition from a great many other vegetable products which could substitute for the staple, and people preferred this greater variety. The advantage of being the premier line among canned forms diminished and demand increased both for the not-so-expensive varieties among them and for the quick-frozen forms. At the same time, major changes were taking place in retailing; supermarkets were developing and more and more large grocery chains were coming into existence. These establishments wanted to see certain types of goods under their own house names and began to place bulk orders with the small canners for their own varieties of the company's staple that fell within this class. As the small canners provided an extremely cheap article (having no marketing expenses and a cheaper raw material), they could undercut the manufacturers' branded product and within three years they captured over 50 percent of the market. Previously, retailers' varieties had accounted for less than 1 percent.

The new automatic factory could not be adapted to the new situation until alternative products with a big sales volume could be

developed, and the scale of research and development, based on the type of market analysis required to identify these, was beyond the scope of the existing resources of the company either in people or in funds.

The changed texture of the environment was not recognized by an able but traditional management until it was too late. They failed entirely to appreciate that a number of outside events were becoming connected with each other in a way that was leading up to irreversible general change. Their first reaction was to make a herculean effort to defend the traditional product, then the board split on whether or not to make entry into the cheaper unbranded market in a supplier role. Group headquarters now felt they had no option but to step in and many upheavals and changes in management took place until a "redefinition of mission" was agreed and slowly and painfully the company re-emerged with a very much altered product mix and something of a new identity.

Four Types of Causal Texture

It was this experience, and a number of others not dissimilar, by no means all of them industrial (and including studies of change problems in hospitals, in prisons and in educational and political organizations) that gradually led us to feel a need for redirecting conceptual attention to the causal texture of the environment, considered as a quasi-independent domain. We have now isolated four "ideal types" of causal texture, approximations to which may be thought of as existing simultaneously in the "real world" of most organizations--though, of course, their weighting will vary enormously from case to case.

The first three of these types have already, and indeed repeatedly, been described--in a large variety of terms and with the emphasis on an equally bewildering variety of special aspects--in the literature of a number of disciplines, ranging from biology to economics and including military theory as well as psychology and sociology. The fourth type,

however, is new, at least to us, and is the one that for some time we have been endeavoring to identify. About the first three, therefore, we can be brief, but the fourth is scarcely understandable without reference to them. Together, the four types may be said to form a series in which the degree of causal texturing is increased, in a new and significant way, as each step is taken. We leave as an open question the need for further steps.

Step One

The simplest type of environmental texture is that in which goals and noxiants ("goods" and "bads") are relatively unchanging in themselves and randomly distributed. This may be called the *placid, randomized environment*. It corresponds to Simon's (1957) idea of a surface over which an organism can locomote: most of this is bare but at isolated, widely scattered points there are little heaps of food (p.137). It also corresponds to Ashby's (1960) limiting case of no connection between the environmental parts (section 15/4) and to Schutzenberger's (1954) random field (p.100). The economists' classical market also corresponds to this type.

A critical property of organizational response under random conditions has been stated by Schutzenberger: that there is no distinction between tactics and strategy, "the optimal strategy is just the simple tactic of attempting to do one's best on a purely local basis" (p.101). The best tactic, moreover, can be learnt only by trial and error for a particular class of local environmental variances (Ashby, 1960:197). While organizations under these conditions can exist adaptively as single and, indeed, quite small units, this becomes progressively more difficult under the other types.

Step Two

More complicated, but still a placid environment, is that which can be characterized in terms of clustering: goals and noxiants are not randomly distributed but band together in certain ways. This may be called

the *placid, clustered environment* and is the case with which Tolman and Brunswik were concerned; it corresponds to Ashby's "serial system" and to the economists' "imperfect competition." The clustering enables some parts to take on roles as signs of other parts or become means-objects with respect to approaching or avoiding. Survival, however, becomes precarious if an organization attempts to deal tactically with each environmental variance as it occurs.

The new feature of organizational response to this kind of environment is the emergence of strategy as distinct from tactics. Survival becomes critically linked with what an organization knows of its environment. To pursue a goal under its nose may lead it into parts of the field fraught with danger, while avoidance of an immediately difficult issue may lead it away from potentially rewarding areas. In the clustered environment the relevant objective is that of "optimal location," some positions being discernible as potentially richer than others.

To reach these positions requires concentration of resources, subordination to the main plan and the development of a "distinctive competence," to use Selznick's (1957) term, in reaching the strategic objective. Organizations under these conditions, therefore, tend to grow in size and also to become hierarchical, with a tendency towards centralized control and coordination.

Step Three

The next level of causal texturing we have called the *disturbed-reactive environment*. It may be compared with Ashby's ultra-stable system or the economists' oligopolistic market. It is a Type II environment in which there is more than one organization of the same kind; indeed, the existence of a number of similar organizations now becomes the dominant characteristic of the environmental field. Each organization does not simply have to take account of the others when they meet at random, but has also to consider that what it

knows can also be known by the others. The part of the environment to which it wishes to move itself in the long run is also the part to which the others seek to move. Knowing this, each will wish to improve its own chances by hindering the others and each will know that the others must not only wish to do likewise, but also know that each knows this. The presence of similar others creates an imbrication, to use a term of Chein's (1943), of some of the causal strands in the environment.

If strategy is 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 Type III environments to be an intermediate level of organization response--that of the operation--to use the term adopted by German and Soviet military theorists, who formally distinguish tactics, operations and strategy. One has now not only to make sequential choices, but to choose actions that will draw off the other organizations. The new element is that of deciding which of someone else's possible tactics one wishes to take place, while ensuring that others of them do not. An operation consists of a campaign involving a planned series of tactical initiatives, calculated reactions by others and counteractions. The flexibility required encourages a certain decentralization and also puts a premium on quality and speed of decision at various peripheral points (Heyworth, 1955).

It now becomes necessary to define the organizational objective in terms not so much of location as of capacity or power to move more or less at will, i.e., to be able to make and meet competitive challenge. This gives particular relevance to strategies of absorption and parasitism. It can also give rise to situations in which stability can be obtained only by a certain coming-to-terms between competitors, whether enterprises, interest groups or governments. One has to know when not to fight to the death.

Step Four

Yet more complex are the environments we have called *turbulent fields*. In these, dynamic processes, which create significant variances for the component organizations, arise from the field itself. Like Type III and unlike the static Types I and II, they are dynamic. Unlike Type III, the dynamic properties arise not simply from the interaction of the component organizations, but also from the field itself. The "ground" is in motion.

Three trends contribute to the emergence of these dynamic field forces:

- The growth to meet Type III conditions of organizations, and linked sets of organizations, so large that their actions are both persistent and strong enough to induce autochthonous processes in the environment. An analogous effect would be that of a company of soldiers marching in step over a bridge.
- The deepening interdependence between the economic and the other facets of the society. This means that economic organizations are increasingly enmeshed in legislation and public regulation.
- The increasing reliance on research and development to achieve the capacity to meet competitive challenge. This leads to a situation in which a change gradient is continuously present in the environmental field.

For organizations, these trends mean a gross increase in their area of relevant uncertainty. The consequences which flow from their actions lead off in ways that become increasingly unpredictable: they do not necessarily fall off with distance, but may at any point be amplified beyond all expectation; similarly, lines of action that are strongly pursued may find themselves attenuated by emergent field forces.

The Salience of Type IV Characteristics (Case 2)

Some of these effects are apparent in what happened to the canning company of Case 1, whose situation represents a transition from an environment largely composed of Type II and Type III characteristics to one where those of Type IV began to gain in salience. The case now to be presented illustrates the combined operation of the three trends described above in an altogether larger environmental field involving a total industry and its relations with the wider society.

The organization concerned is the National Farmers Union (NFU) of Great Britain to which more than 200,000 of the 250,000 farmers of England and Wales belong. The presenting problem brought to us for investigation was that of communications. Headquarters felt, and was deemed to be, out of touch with county branches, and these with local branches. The farmer had looked to the NFU very largely to protect him against market fluctuations by negotiating a comprehensive deal with the government at annual reviews concerned with the level of price support. These reviews had enabled home agriculture to maintain a steady state during two decades when the threat, or existence, of war in relation to the type of military technology then in being had made it imperative to maintain a high level of home-grown food without increasing prices to the consumer. This policy, however, was becoming obsolete as the conditions of thermonuclear stalemate established themselves. A level of support could no longer be counted upon which would keep in existence small and inefficient farmers--often on marginal land and dependent on family labor--compared with efficient medium-size farms, to say nothing of large and highly mechanized undertakings.

It was the former situation which had produced NFU cohesion. As this situation receded, not only were farmers becoming exposed to more competition from each other, as well as from Commonwealth and European farmers, but the effects were being felt of very great changes which had been taking place on both the supply and marketing sides of the industry. On the

supply side, a small number of giant firms now supplied almost all the requirements in fertilizer, machinery, seeds, veterinary products, etc. As efficient farming depended upon ever greater utilization of these resources, their controllers exerted correspondingly greater power over the farmers. Even more dramatic were the changes in the marketing of farm produce. Highly organized food processing and distributing industries had grown up, dominated again by a few large firms, on contracts from which (fashioned to suit their rather than his interests) the farmer was becoming increasingly dependent. From both sides deep inroads were being made on his autonomy.

It became clear that the source of the felt difficulty about communications lay in radical environmental changes which were confronting the organization with problems it was ill-adapted to meet. Communications about these changes were being interpreted or acted upon as if they referred to the "traditional" situation. Only through a parallel analysis of the environment and the NFU was progress made towards developing understanding on the basis of which attempts to devise adaptive organizational policies and forms could be made. Not least among the problems was that of creating a bureaucratic elite that could cope with the highly technical long-range planning now required and yet remain loyal to the democratic values of the NFU. Equally difficult was that of developing mediating institutions--agencies that would effectively mediate the relations between agriculture and other economic sectors without triggering massive competitive processes.

These environmental changes and the organizational crisis they induced were fully apparent two or three years before the question of Britain's possible entry into the Common Market first appeared on the political agenda--which, of course, further complicated every issue.

A workable solution needed to preserve reasonable autonomy for the farmers as an occupational group, while meeting the interests of other sections of the community. Any such possibility depended on securing the consent of the large majority of farmers to placing under NFU control matters that hitherto had remained within their own power of decision. These included

what they produced, how and to what standard, and how most of it should be marketed. Such thoughts were anathema for, however dependent the farmer had grown on the NFU, he also remained intensely individualistic. He was being asked, he now felt, to redefine his identity, reverse his basic values and refashion his organization--all at the same time. It is scarcely surprising that progress has been, and remains, both fitful and slow and ridden with conflict.

Values and Relevant Uncertainty

What becomes precarious under Type IV conditions is how organizational stability can be achieved. In these environments individual organizations, however large, cannot expect to adapt successfully simply through their own direct actions--as is evident in the case of the NFU. Nevertheless, there are some indications of a solution that may have the same general significance for these environments as have strategy and operations for Types II and III. This is the emergence of *values that have overriding significance for all members of the field*. Social values are here regarded as coping mechanisms that make it possible to deal with persisting areas of relevant uncertainty. Unable to trace out the consequences of their actions as these are amplified and resonated through their extended social fields, men in all societies have sought rules, sometimes categorical, such as the Ten Commandments, to provide them with a guide and ready calculus. Values are not strategies or tactics; as Lewin (1936) has pointed out, they have the conceptual character of "power fields" and act as injunctions.

So far as effective values emerge, the character of richly joined, turbulent fields changes in a most striking fashion. The relevance of large classes of events no longer has to be sought in an intricate mesh of diverging causal strands but is given directly in the ethical code. By this transformation a field is created which is no longer richly joined and turbulent but simplified and relatively static. Such a transformation will be

regressive, or constructively adaptive, according to how far the emergent values adequately represent the new environmental requirements.

Ashby (1960), as a biologist, has stated his view, on the one hand, that examples of environments that are both large and richly connected are not common, for our terrestrial environment is widely characterized by being highly subdivided; and, on the other, that, so far as they are encountered, they may well be beyond the limits of human adaptation, the brain being an ultra-stable system. By contrast the role here attributed to social values suggests that this sort of environment may, in fact, be not only one to which adaptation is possible, however difficult, but one that has been increasingly characteristic of the human condition since the beginning of settled communities. Also, let us not forget that values can be rational as well as irrational and that the rationality of their rationale is likely to become more powerful as the scientific ethos takes greater hold in a society.

Matrix Organization and Institutional Success

Nevertheless, turbulent fields demand some overall form of organization that is essentially different from the hierarchically structured forms to which we are accustomed. Whereas Type III environments require one or other form of accommodation between like, 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. This means relationships that will maximize cooperation and which recognize that no one organization can take over the role of "the other" and become paramount. We are inclined to speak of this type of relationship as an *organizational matrix*. Such a matrix acts in the first place by delimiting on value criteria the character of what may be included in the field specified--and therefore who. This selectivity then

enables some definable shape to be worked out without recourse to much in the way of formal hierarchy among members. Professional associations provide one model of which there has been long experience.

We do not suggest that in other fields than the professional the requisite sanctioning can be provided only by state-controlled bodies. Indeed, the reverse is far more likely. Nor do we suggest that organizational matrices will function so as to eliminate the need for other measures to achieve stability. As with values, matrix organizations, even if successful, will only help to transform turbulent environments into the kinds of environment we have discussed as "clustered" and "disturbed-reactive." Though, with these transformations, an organization could hope to achieve a degree of stability through its strategies, operation and tactics, the transformations would not provide environments identical with the originals. The strategic objective in the transformed cases could no longer be stated simply in terms of optimal location (as in Type II) or power/capabilities (as in Type III). It must now rather be formulated in terms of *institutionalization*. According to Selznick (1957) organizations become institutions through the embodiment of organizational values which relate them to the wider society.² As Selznick (1957) has stated in his analysis of leadership in the modern American corporation, "the default of leadership shows itself in an acute form when organizational achievement or survival is confounded with institutional success (p.27)... the executive becomes a statesman as he makes the transition from administrative management to institutional leadership." (p.154)

The processes of strategic planning now also become modified.

²Since the present paper was presented, this line of thought has been further developed by Churchman and Emery (Vol.III) in their discussion of the relation of the statistical aggregate of individuals to structured role sets:

Like other values, organizational values emerge to cope with relevant uncertainties and gain their authority from their reference to the requirements of larger systems within which people's interest are largely concordant.

Insofar as institutionalization becomes a prerequisite for stability, the determination of policy will necessitate not only a bias towards goals that are congruent with the organization's own character, but also a selection of goal-paths that offer maximum convergence as regards the interests of other parties. This became a central issue for the NFU and is becoming one now for organizations such as the National Economic Development Council, which has the task of creating a matrix in which the British economy can function at something better than the stop/go level.

Such organizations arise from the need to meet problems emanating from Type IV environments. Unless this is recognized, they will only too easily be construed in Type III terms and attempts will be made to secure for them a degree of monolithic power that will be resisted overtly in democratic societies and covertly in others. In the one case, they may be prevented from ever undertaking their missions; in the other, one may wonder how long they can succeed in maintaining them.

An organizational matrix implies what McGregor (1960) has called Theory Y. This, in turn, implies a new set of values. But values are psycho-social commodities that come into existence only rather slowly. Very little systematic work has yet been done on the establishment of new systems of values or on the type of criteria that might be adduced to allow their effectiveness to be empirically tested. A pioneer attempt is that of Churchman and Ackoff (1950). Likert (1961) has suggested that, in the large corporation or government establishment, it may well take some 10 to 15 years before the new type of group values with which he is concerned could permeate the total organization. For a new set to permeate a whole modern society the time required must be much longer--at least a generation, according to the common saying--and this, indeed, must be a minimum. One may ask if this is fast enough given the rate at which Type IV environments are becoming salient. A compelling task for social scientists is to direct more research onto these problems.

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