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PROGRESS AND HAZARD*

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The title of this note juxtaposes two apparently conflicting terms neither of which has at the present time a well-defined meaning. An objective definition of progress whether in the biological and evolutionary sense or in human undertakings is not easily given.¹ Progress from one aspect may be stagnation from another. Even progress recognized as such by all concerned, may over a longer view prove to have been the prelude to disaster. Hazard² is often confused with several other terms which should bear distinct meanings; such as randomness, chance, accident, uncertainty, danger and risk. The peculiar nature of hazard is obscured by this confusion.

I propose to define the two terms in a form that seems to be reasonably free from ambiguity. Any system undergoing change has at a given moment t_1 , a limited capacity for internal modification and hence a limited capacity for interaction with its environment. We may call this its intrinsic potential and define PROGRESS as a change of state such that the intrinsic potential P of a system at time t_1 , is greater than at any earlier time t_0 . On the principle 'call no man happy until he is dead', this definition is not valid before or after time t_1 . Nevertheless, it does link progress to a specific property; the potential for internal modification and external interaction.

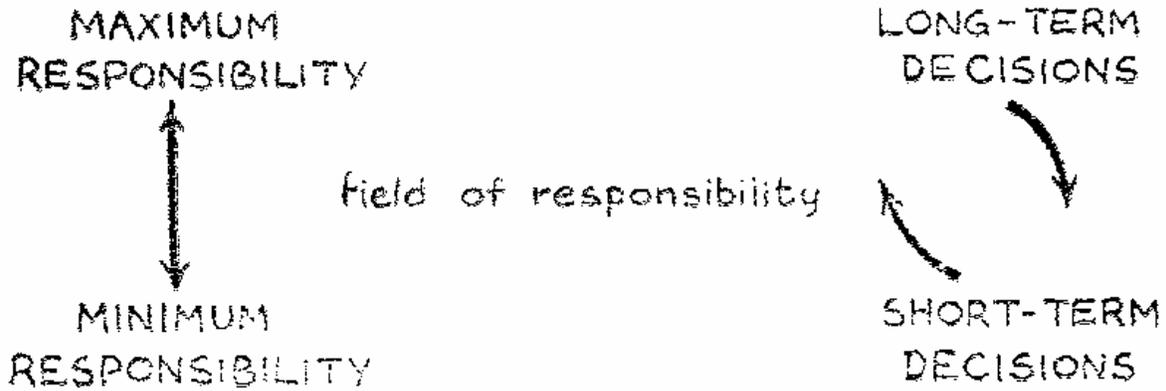
Hazard requires two distinct concepts for its definition. One is the concept of purpose and its attainment and the other is that of uncertainty and unpredictability. A situation is one of HAZARD if it is associated with a purpose the attainment of which is subject to an unknown degree of uncertainty.

The thesis, that will be developed in the present note, asserts that progress cannot occur in the absence of hazard and hence, by the very of hazard itself, must be unpredictable and uncertain. The thesis is almost self-evident in the case of biological evolution, but is commonly disregarded in human affairs. There has until recently been an almost mystical belief in the inevitability of human progress. The twentieth century has done much to dispel the illusion.

I shall examine the thesis as it applies to human organizations engaged in transforming raw materials into socially useful products. A large industrial concern and an educational complex provide characteristic examples. Any such system operates in an environment from which it draws its raw materials and to which it furnishes its products. It operates at different levels of responsibility, from the worker on the shop floor or the child in the class-room to the management committee that takes decisions affecting operations years or even decades ahead. The entire system is pervaded by decision requirements; but these differ so greatly in scale as to appear unconnected. A hundred thousand operatives making decisions effectual only over hours or even minutes have an immense influence on efficiency but little, apparently, on long-range planning. A committee

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of three or four executives can do little or nothing to deal with the hour-by-hour contingencies, but its decisions will affect the future welfare of the entire organization. At every intermediate stage, decisions are required and taken. The polarity of responsibility sets up a field that pervades the entire organization and can be represented as a dyad.³



Without this field, there can be no organization, and it plays much the same part as the organizing field of the fertilized ovum. From the moment that there is polarization of responsibility, progress is possible. The division of responsibility introduces uncertainty of precisely the kind that falls within my definition of hazard. This is the primary argument for the thesis that progress and hazard are inseparable.

The objection can be made that the organization may be so well regulated that all decisions on all levels are consistent, so that uncertainty is eliminated. This argument cannot be discussed - either positively or negatively - within the limits of the two-term system. It turns upon the question 'how will the system work?' and this cannot be decided in terms of the dyadic force field alone. The situation is analogous to that of a system of bodies moving in a field of force where collisions have to be taken into consideration. The behaviour of the bodies cannot be predicted unless we know their surface energy, elasticity, brittleness and other intrinsic properties. The corresponding requirement in a human system consists in knowing the modes of interaction between the organization and its environment and between the different components of the organization itself.

These modes of interaction arise from the dynamism of the organization as distinct from its force field. They can therefore be represented by the triad with its three independent terms.

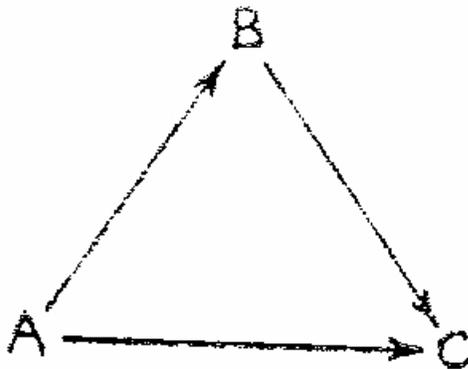
The triad, or three-term system, must satisfy the general definition of any system which requires it to be a coalescence of distinct yet mutually relevant terms. Each term has a generic character that reappears in an endless variety of forms. I have designated these affirmation, receptivity and reconciliation.⁴ They are exemplified in the triad father - mother - child. This triad like every other has a structure that is lacking in the dyad, inasmuch as the positions of the terms can be distinguished. Each of the six resulting combinations is an element in the dynamism of the relationship. The six elements can be expressed in words without pretension to precision in the following scheme.

Father - Mother - Child
 Father - Child - Mother
 Mother - Father - Child
 Mother - Child - Father
 Child - Father - Mother
 Child - Mother - Father

Increase and multiply
 The bond of society
 Maternity and fulfillment
 The home-maker, the family
 Transmission by heredity
 Procreation: " the child is father to the man " .

By coalescing the six elements, we can form a " picture in depth " of the dynamism latent in the relationship of parenthood.

Each of the pairs represents an interaction. As applied to the study of organizations in operation, the six interactions determine a possible strategy. The choice between modes can be called the strategic option. The form of a strategy can be represented diagrammatically thus



A = initiation of strategy

B = operational means

C = point of impact

For convenience, this form is usually written: A-B-C. The triadic system, with its attributes of dynamism and relationship, is constituted by the coalescence of three terms which can be separately defined as follows. The first - symbol 1 - is authority, command or affirmation, normally concerned with decision making. The second - symbol 2 - is cooperation, responsiveness or receptivity normally concerned with carrying out decisions. The third - symbol 3 - is adaptiveness, skill and recognition of the unpredictable and contingent element in all operations. It is connected with the positive contribution that hazard can make to the dynamism; but also with the risk of failure.

The strategic option consists in the ability to assign a specific role - i.e. a specific position in the strategy - to each of the terms. If two are assigned then the third automatically enters the vacant position. The management can exercise authority and it can define the function of the responsive medium; but it cannot control the third factor. When a situation is understood, authority can be asserted at any one of the three points and the receptive term can be allotted to either of the two remaining places. The third place is then subject to hazard, and can be adapted to the decision taken only by the exercise of special insight and skill that is quite distinct from making or carrying out decisions. In one of its many forms, this skill is called 'trouble-shooting' and in another 'flair' or 'discrimination'. When this quality is absent, the organization is defenceless against the incidence of hazard wherever it may be situated. The choice of strategic option is usually dictated by temperament or habit and the consequential requirement that hazard should be taken care of is either neglected, or met in the wrong way by treating hazard as a 'contingency' that can be allowed for by providing an excess of responsive capacity. Strategical decision making should properly speaking be confined to the selection of strategic options at those relatively few moments when an effective choice is open.

The six strategic options are derived from the six fundamental relationships,⁵ expansion, concentration, identity, interaction, order and freedom. We need other descriptive names to bring out the connection with progress.

DOMINATION Triad 1-2-3. The initiative is decided by authority and the responsive medium serves as the operational means. This strategy throws the hazard to the point of impact where it operates as resistance to domination and results in the need to make further commitment. This can be described as 'hawkish' strategy. It can succeed only when all the terms are precisely coordinated.

CONCENTRATION Triad 2-1-3. The initiative is placed within the responsive medium and authority is exercised to build up the effectiveness of the organization. The hazard is again at the point of impact, but with the advantage of non-commitment. The skill in operating this strategy is mainly in finding the right moment to pass from internal built-up to operation. Historically, the strategy is exemplified in men like Philip of Macedon or Frederick Wilhelm I of Prussia, or in the rise of great movements which remain unknown to the world so long as they maintain the strategy of concentration. It may be noted that a transition to domination occurs when the initiative is assumed by authority and the movement is 'institutionalized'.

VIABILITY Triad 2-3-1. Though, as in the previous case, the initiative is taken in the responsive medium, the authority is placed at the point of impact. The hazard is thereby drawn into the inner working of the organization and is dealt with operationally. Since hazard cannot be foreseen, this strategy calls for constant vigilance to recognize symptoms of trouble arising. This strategy shields the system from external hazard, but at the same time tends to render it sterile. It relies upon the image it presents to its environment, but does not seek to innovate or adapt.⁶ The strategy of viability is required for certain operations of every organization, but if it pervades the entire system, it is likely to end in stagnation. Many large and successful organizations exhibit this tendency.

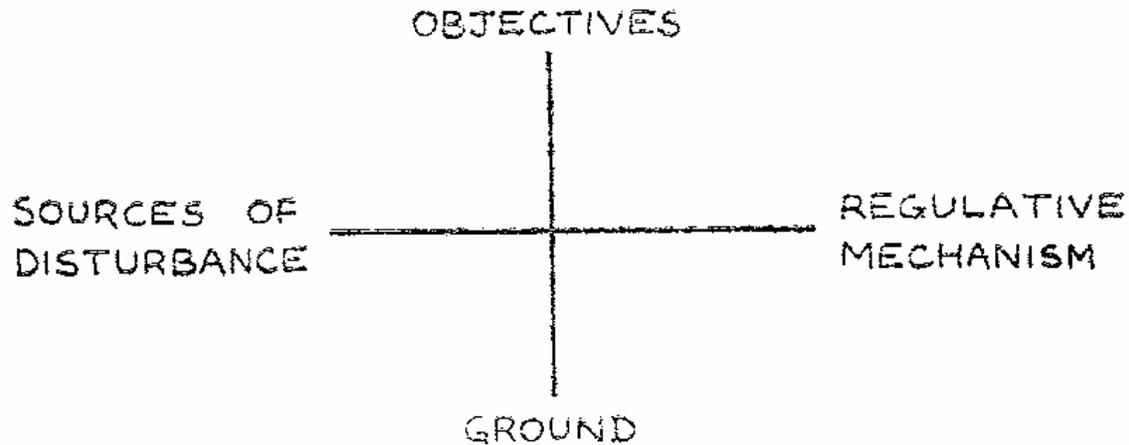
ADAPTABILITY Triad 1-3-2. As before the hazard is absorbed into the field of operation, but the strategy is affirmative. It is characterized by an active policy adopted by the management, with attention directed to the environment. The organization is faced with hazards arising from the interaction and depends upon its ability to meet them successfully. A high degree of managerial skill is called for, because the risk in adopting this strategy lies in the direct contact between the subordinate echelons and the environment. The transmission of managerial decisions is subject to hazard and often leads to bad timing. These are recognizable characteristics of any system that relies for its strategy upon its own initiative without being in full control of its instruments. In this lies the distinction between a dominant strategy 1-2-3 and an adaptive strategy 1-3-2.

NORMATIVITY Triad 3-1-2. This is essentially the planner's strategy. The system starts with seeking to establish the norms of policy and their implementation. It forecasts and exposes the organization to the environment according to a predetermined plan. Ideally, this strategy eliminates hazard by dealing with it before the operation starts, but in practice and indeed in principle-the requisite information is never fully available. Normative strategy is very powerful even when not completed and it is coming increasingly into favour. There is even a tendency to over-rate its effectiveness.

CREATIVITY Triad 3-2-1. The creative genius delights in hazard. It is his challenge and his starting point. The creative strategy by which new enterprises are brought into being in an indifferent or hostile environment requires a direct impact of the authority at the point of application. The organization grows in the process of being used and in doing so throws up new hazards that are met by improvisation. This strategy produces the most spectacular achievements: but it has the inherent defect that it does not provide for the orderly growth of its own instrument.

It will be evident that none of the six strategies taken alone is likely to guarantee progress, and yet all of them make it possible. We cannot predict what combination will ensure progress under a given set of conditions. In order to criticize and understand the triad, we must turn to the tetrad or four-term system that is the form of ordered or directed activity.⁷

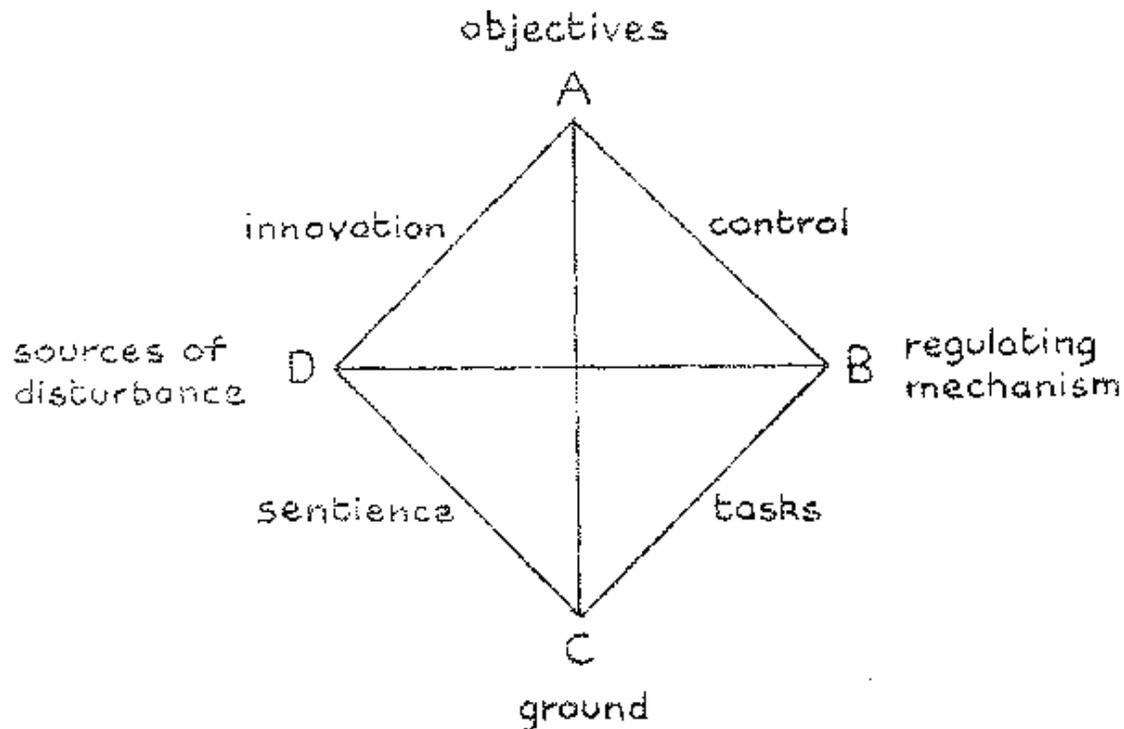
As applied to an organized complex system, the tetrad comprises four terms, of which two serve to establish the direction of change and two provide the conditions for change to proceed in the manner required. The first pair are called motivational and the second pair instrumental terms of the system. Each of the four terms will generally be a complex of operations or processes.



The lower term stands for the complex of people, equipment, buildings and raw materials as they are involved in the activity of the organization. The upper term includes the general and specific potential of the organization, the effects it proposes to produce within the environment and within its own structure. The vertical line indicates the entire range of short and long term objectives and the stages through which they are to be achieved. The distinction is not that of responsibility as in the dyad but rather that of potential and actual. The term on the right, labelled 'regulating mechanism' comprises all the means, internal and external, by which the organization operates. When combined with the motivational terms it forms a homeostatic system that seeks not only to maintain, but to optimize its own operations. The system operating solely as a homeostat could adapt to varying environmental pressures; but it could not change the character of its motivations, nor could it deal with contingencies for which the regulative mechanism made no provision. In short, it could maintain itself, but it could not progress.

We find the condition of progress in the term on the left of the horizontal axis labelled 'sources of disturbance'. These upset the homeostatic equilibrium and compel the organization to make adjustments, not only in order to maintain itself but to extend its operations to take account of the new factors. In this way, the hazard of unpredictable disturbance becomes a factor of growth. Now, growth alone is not progress; and it is, therefore, necessary to introduce a selection principle that accepts the progressive changes and neutralizes any tendency towards useless complexification. In evolutionary theory, this principle is referred to as the orthogenetic factor, the operation of which is not explained by any model of biological evolution that has yet been put forward. In our model, the balance between growth and progress is maintained by the interaction of the motivational terms with the 'sources of disturbance' term. Corresponding to the orthogenetic principle, we have the principle of 'control through adequate variety' that has proved so fruitful in the development of structural communication.⁸

Each of the four terms of the tetrad interact along the six lines shown in the diagram below. The six interactions-called in systematics the six first-order connectivities-give the organization as a whole the combination of inner stability with outward effectiveness and true or objective progress that should be the aim of any such system.



A - C MOTIVATIONAL AXIS. The strength of this interaction is a measure of the sense of purpose and fulfilment that pervades all levels of activity. It requires constant vigilance to ensure that the actual state of the organization-the Ground-is not allowed to escape from the pull of the potential states-the Objectives. This axis alone cannot ensure progress in the true sense, for the latter requires not only the realization of the existing potential, but an increase in the potential itself. This is in accordance with the criterion we have adopted in our definition. There will be an hierarchy of motivations from top to bottom of the axis corresponding to the degree of involvement of the elements concerned. It should be noted that even buildings and equipment can be motivationally charged, they can encourage stagnation at one extreme and progress at the other.

B - D OPERATIONAL AXIS. This axis touches at one end the routine activities of all parts of the organization including those that are wholly automatic or homeostatic. Towards the other end, the axis goes through various degrees of unpredictable hazard up to catastrophic disruption. It thus comprises the entire working life of the organization including its inner activities and external relationships. It uses every kind of instrument from lands and buildings to personal direction and decision-making. It does not include policy-making which belongs to the motivational axis.

A - B CONTROL AXIS. The link between policy and operation is made through the axis connecting objectives and the regulative mechanism: no control is possible without variety. The possibility of control arises from hazards large and small, whereas the *exercise* of control depends upon the versatility of the regulative mechanism. This must allow sufficient variation of control procedures to enable the requirements of progress to be reconciled with the demand for internal stability. Control for progress is thus quite distinct from control for survival. This in turn is distinct from control for stability or the maintenance of standard specifications. Progress requires survival and stability, but it also threatens both of them with disruption. Here again we see the necessity for hazard.

A - D INNOVATION AXIS. The direct positive role of hazard is to make innovation possible. It requires the re-examination of objectives any one of which may be made impossible of achievement by unpredictable contingencies. It also opens unforeseen opportunities for defining new objectives and taking decisions of a progressive character. Innovation is not necessarily progressive since it may be required to adapt to changed

circumstances for reasons of viability alone. This axis comprises all aspects of policy-making, because there can be no 'policy' without variation and no variation without disturbance.

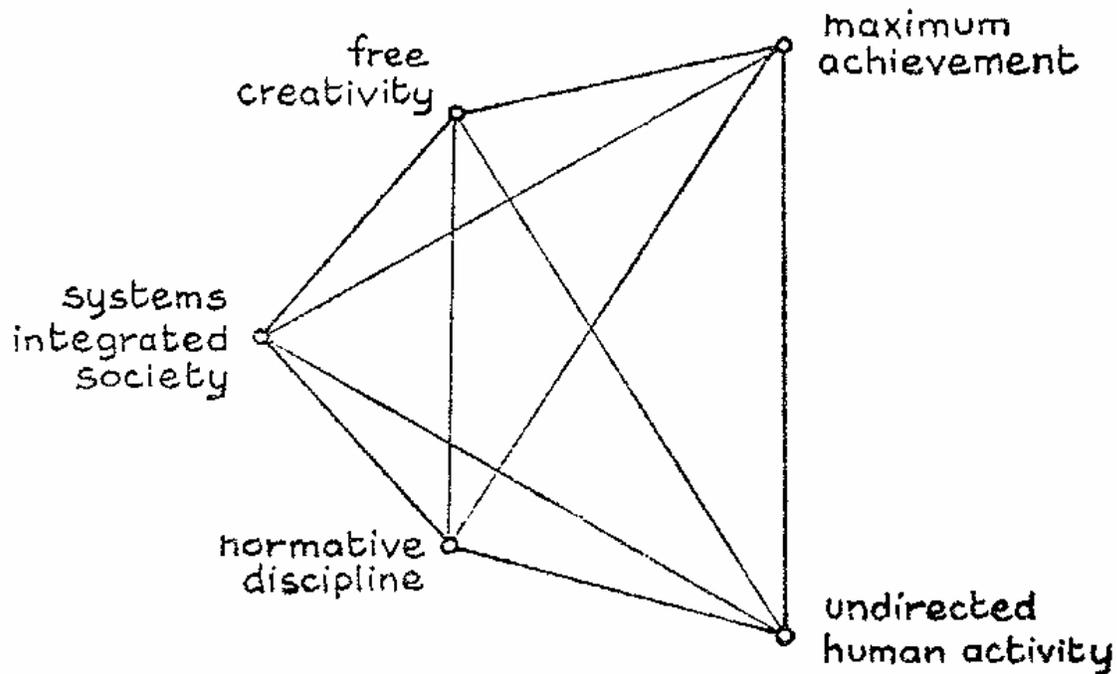
B - C TASK AXIS. The coherence and effectiveness of the organization depend upon the strength of the axis. It includes the chain of command down to the maintenance of premises and equipment. It influences progress by the need to maintain flexibility and this in its turn requires variety that must introduce elements of hazard. The more the organization is geared to progress, the greater the element of hazard the task groups must accept. Task administration is to be distinguished from decision-making, and therefore from control.

D - C SENTIENT AXIS. The prompt recognition and evaluation of disturbing factors is essential for any organization that is not satisfied with passive survival. The term sentience comprises all the means whereby the system-as it actually is and not as it might or ought to be-detects environmental and internal trends before they produce a crisis.⁹ Hazard is by definition unpredictable, but it is not undetectable in its operations. There is a mistaken tendency to treat the unpredictable and contingent as a hostile element. This disregards the well-established observation that progress always comes in unexpected ways. The successful organization is the one which detects hazard before its competitors and sees how it can be used as a factor of progress. This is not to say that sensitivity to real danger is unnecessary, but only that positive hazard is more often overlooked. In any organization, the sentient groups must be recognized as distinct from task groups.

In discussing directed activity in the form of the tetrad, I have assumed that success and failure can be assessed. By analogy with Gödel's principle,¹⁰ we should not expect to criticize the tetrad completely within its own framework.

The pentad is specifically the system for evaluation of significance and I shall consider this as the last stage of our enquiry. Evaluation is a curious activity. We seek a single unambiguous assessment of what is usually a complex, heterogeneous and self-contradictory situation. We require a combination of realism and idealism that will do justice to the pragmatic and actual content as well as to the highest potential level of operation. We need some objective criterion independent of the system itself and we must also take into account its own unlimited (i.e. down to atomic dimensions) complexity and draw the line somewhere as the limit of our possible grasp of the problem. These requirements can be placed in five groups forming the terms of a pentad.¹¹ To illustrate the theme of progress and hazard, we can take the structure of any human society as an integrated system.

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The concept of a systems integrated society is that of a multi-level structure such that each level is self-sufficient and yet interacts with the others. This must result in occasions for hazard, because inter-level interactions are unpredictable from any single level. The levels will comprise geography, minerals, climate, and soil, vegetable and animal life-providing foodstuffs and raw materials, and the economic and technological, sociological and cultural, creative and religious activities of man. The entire system must have a common set of accepted values or it could not form an integrated society, This is the term we must look for to give us an objective measure of progress.

The activity of the system falls between upper and lower limits. In the restricted sense it is concerned with self-realization. This is designated as normative discipline. It leads to evaluation based upon accepted norms and canons of behaviour and operates through common sense, the social standard and the instruments of communication and government. At the upper limit, there is the creative activity common to all members of the society; manifesting as human love, art, literature, scientific research, invention, social reform and the revolutionary spirit.

The over-riding limits of assessment are set by the nature of man: himself. A great part of human activity is undirected and non-purposive. This corresponds to the 'noise' in a communication system and is a necessary condition for control. It is wasteful only in the same sense that a heat engine is wasteful as it turns thermal energy to useful work at the expense of random motion, that is, low-grade heat. The random character of so great a part of human activity renders it liable at all times to petty hazard; whereas creative activity exposes the society to major hazard. There is no advantage in pushing the limit of assessment below the level of human activity. Sub-human processes are extraneous to the human society we are seeking to evaluate.

There must always be an upper limit to the possible achievement of any society: human or non-human. We place this at the summit of the pentad. Since we are concerned with progress, the maximum achievement is unknowable at any moment and unpredictable in the future. Unlike a goal, it has no end-point and yet it is a

very real factor in the life of any virile society. It introduces hazards of a totally different nature from those that enter at the lower limit.

It would go beyond the scope of this note to consider the ten connectivities by which the society is held together in a nexus of significances and meanings. It should, however, be clear that no static assessment of a progressive society could serve a useful purpose. Progress is movement into the unknown and unpredictable and yet it is not blind and undirected. In this lies the paradox of progress. To reduce the paradox to a conceptually useful model, we need to examine the five terms and all their interconnections. This examination sets up a complex and yet consistent criterion of progress that preserves the necessary element of unpredictability.

The discussion has been entirely general and applicable to any society in which a single set of consistent values is accepted. It would apply to an industrial concern, to a school or educational complex and to any purposive undertaking in which the human elements are united by community of purpose.

SUMMARY

We define progress as increase of potential. This cannot occur without a direction or purpose, but purpose must involve uncertainty of attainment and hence hazard. In a complex organization, hazard is introduced by the conflict of long-term and short-term objectives which require a division of responsibility. Strategy is the way in which resources are deployed: it requires a three-term system or triad, and hence there are six basic strategies. Each of these involves hazard and the point of incidence of the hazard is also the point at which the highest order of creative insight and skill must be brought to bear. Failure to recognize this results in a wrong appreciation of the positive role of hazard in human undertakings. The activity of an organization can become progressive only through influences that disturb its equilibrium. The tetrad is the simplest system that allows progressive activity to be studied. We come finally to evaluation of significance. This requires a five-term system. At every stage hazard plays a decisive part in making progress possible.

The concept of hazard/progress is applicable to any organized system operating across an interface in any environment. An industrial concern or an educational complex provide typical situations in which the concept can be applied in practice.

NOTES

1 Huxley, J. *Evolution: the Modern Synthesis* pp. 556. "There still exists a very great deal of confusion among biologists on the subject of evolutionary and biological progress." *ibid.* p. 563 "progress must in part at least be defined on the basis of final results." *ibid.* p. 564 "a progressive advance may eventually come to a dead end."

2 Bennett, J. G. *The Dramatic Universe*, Vol. I p. 20. "Conscious experience faced with hazard is a state of need, and need confronted with uncertainty as to its fulfilment is dramatic."

3 *ibid.* Vol. III pp. 18-23. The poles of a dyad are complementary. Maximum responsibility sets up no field of force unless a minimum responsibility also pervades the system

4 *ibid.* Vol. II, Chapter 27, pp. 85-90.

5 *ibid.* Vol. II pp. 100-128. 'The six fundamental laws.' The connection between strategy and understanding is developed here and in Vol. III p. 23-29.

6 c.f. Daniel J. Boorstin *The Image*. The author calls his book 'an examination of American self-deception'. This is not altogether fair, since the 'image projecting strategy' can be adopted without either deception or self-deception. Its weakness lies in its tendency to stifle self-criticism.

7 *ibid.* Vol. II pp. 243-4 and Vol. III pp. 30-35, especially the diagram on p. 34.

8 Systematics Vol. V No. 3 for full account of structural communication in the present stage of development

9 Muller, L. S. and Price, E. K. *Systems of Organization. The Control of Task and Sentient Boundaries*, p. 260. 'To maintain adaptiveness, the greatest sentence must remain vested in a group committed to change.' *ibid.* p. 225. 'In any enterprise the sentient groups of its members have to be identified and differentiated from task groups.'

10 Gödel K. 'On formally undecidable statements'. In any symbolic system enough to contain its own logic, it is possible to construct statements which cannot be demonstrated or refuted within the system itself, even though they may be in a system of a higher order.

11 *loc. cit.* Vol. III pp. 37-44. and Vol. II Chapter 35. 'If we are to specify how a structure is significant for itself and for the totality that contains it, we must go beyond the tetrad and add meaning and potentiality to activity. A structure becomes an entity only when it has meaning and potentiality in its own right.' Again, (p. 42) 'The combination of significant identity with the possibility of undergoing change, requires a five-term structure.' The peculiar character of progress is discussed (*ibid.* Vol. IV p. 145 *passim*) in its biological significance. By distinguishing it from diversification and viability both of which may progress is seen to be inseparable from intelligence (*ibid.* p. 164).