UNDERSTANDING HUMAN SYSTEMS

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THROUGHOUT history, mankind has known of various ways to attain higher levels of awareness. Ever since language become the organ of consciousness; man has attempted to reach greater heights of personal achievement both in the physical and mental fields. It is unique to him that man lives, unlike all other animals, in a three-fold space; physical, social and spiritual (cultural, if one objects to spiritual). Living in the human sense is much more than adaptation, survival and homeostasis. It is something broader and deeper. Creativity and self-realization are uniquely characteristic of man and might indeed be the ingredients of his future evolution. This is the central theme of a book* dealing, perhaps for the first time, with the problems of the evolution of man from a 'transdisciplinary' point of view. Edited by Erich Jantsch and Conrad Waddington, it includes contributions by eminent scientists, philosophers, sociologists, systems science specialists, all looking at human evolution in its totality. It outlines our understanding of the movement of human evolution from the physical, biological, and socio-biological to socio-cultural aspects. It deals, in addition to scientific questions, with existential ones, such as the meaning of life, specially relevant to man and his future.

Organic Evolution and Man

It is recognized that the origin of man marked a continuation and perhaps a culmination of the evolutionary processes which started long before man appeared on the scene, and it remains, not only with scientists but with philosophers and creative artists as well, an interesting inquiry as to the future of man and the processes through which this future is likely to be achieved. The well-known cliché that organic evolution through natural selection has now come to an end and that man's future evolution lies entirely in his culture is only partially true. That cultural communication of a unique kind is now available to him has to be granted. That evolution of the past which led to the creation of new species of animals should yield place to evolution of society and of the individual in man is also clear. But it is now being increasingly recognized that man still remains subject to the shaping influences of natural selection and his physical evolution has not, as some will argue, come to a halt. True enough, these influences are being reduced in some respects, as through medical technology; it is also true that it is being intensified in others, as through pollution, disease and other man-made hazards. Waddington argues that to maintain that natural selection has become inoperative in relation to man is to create a too simplistic impression of the role of culture and the current human condition. It is more nearly a situation of *quid pro quo*, where, while certain selection pressures have been reduced or eliminated, others have been substituted. It is important to note that natural selection acts on phenotypes which become adapted during their lifetime by physiological processes to meet their particular stresses. Selection would act on populations subjected to these stresses and there is certain to be some genetic variation in the capacity of different individuals to respond to these stresses. Living organisms including man are open-ended, non-linear systems and an adaptive change originally induced by some environmental stress may, after continual selection over many generations, form part of the hereditary endowment of a later generation. Once we consider evolution in terms of selection of phenotypes, we find ourselves forced to conclude that in man, perhaps a little less than in sub-human animals, biological evolution is a matter of 'interlocking series of open-ended, cybernetic, circular processes'. While it is true that in lower animals, cultural transmission of information has played a relatively minor role, in man it is characterized by an enormously greater development of this type of sociogenetic mechanism operating through the agency of language. A qualitative difference does exist between human evolution and evolution of other animals but it does not seem to exclude natural selection altogether.

What is this cultural evolution? What is the present state of the human system? What are the possible directions in which this evolution may take place? It takes more than a prophet to discern the lineaments of future man, but it should not be difficult to outline, on the basis of the past evolution of man and his present condition, the steps to be taken to secure a reasonable assurance of his future.

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* *Evolution and Consciousness: Human Systems in Transition*: Ed. Erich Jantsch and Conrad H. Waddington, Addison-Wesley Pub. Co., 1976, p. 359.

Waddington, Walter Pankow and Erich Jantsch, emphasise the openness of living systems, not merely the openness to flows of energy, matter and information but one which goes beyond it. The human world incorporates the basic principle of self-transcendence, of venturing out to change its physical, social and cultural conditions and especially to change its own consciousness. This continuous self-renewal and self-expression are unique to the human system. Any attempt to impose boundaries to this system becomes counter-productive. The human world is not one of equilibrium perfection, stability and predictability. Indeed, its present features as well as the possibilities of its future lie in its imperfection, non-equilibrium, non-predictability and symbiotic pluralism.

C. S. Holling provides evidence for this by his concept of 'continuity in change'. His studies of ecological systems have revealed that their dynamics cannot be explained by an equilibrium-centered view. Resilience, or capability to persist through changes, is linked to high fluctuations. Any attempt to stabilize an ecosystem ruins it. What evolution seems to do is not develop efficiency but flexibility to persist. High resilience, high fluctuations lead to and induce persistence.

Order Through Fluctuation

Holling's premise seems naturally to lead to the most important chapter, that of Ilya Prigogine, who emphasises the non-equilibrium state as inherent in life at all levels. In a highly penetrating analysis of physical, chemical and biological systems, including that of Man, Prigogine develops his concept of Order through Fluctuation'. Fluctuations play a relatively minor role in classical physics. The whole domain of classical thermodynamics based on Boltzmann's Principle illustrates this. On the other hand, non-linear systems under non-equilibrium conditions bring about fluctuations which lead to new states. Indeed, 'dissipative structures' are themselves fluctuations which are continuously in exchange with their environment, and their evolution contains an essential stochastic element. Prigogine has developed new mathematical equations to deal with both deterministic as well as stochastic phenomena. This has become relevant in view of the wide gap that still separates physics and biology, between study of simple motions met with in rational mechanics and the very complex but orderly movements of chromosomes during mitosis or of cells during embryonic development. The idea of evolution in physics and that in biology are markedly in contrast. In physics, entropy marks a progressive disorganization of the system. In biology, it is accompanied by a progressive structuration culminating in the complicated organization of human society. Prigogine's is perhaps the first notable attempt towards a new mathematics, a 'bioalgebra', for studying living systems. And it now seems possible to go further and discuss more precisely the basic concepts in biology and sociology in mathematical terms as has already been done, for instance, by Volterra in ecology.

Biological Systems Autopoietic

Ralph Abraham discusses the principles and applications of macrodynamics in the light of recent developments, especially the theory of catastrophes developed by René Thom. A macron is a stable regime in a dynamic system and many examples abound in physical, chemical and electrical systems. Attempts to apply macro-dynamics to biology, especially to neurophysiology have only just begun and are yet at a purely conjectural stage. On the other hand, biological systems are autopoietic, self-renewing, self-repairing and unity-maintaining, autonomous organizations. An animal cell is an example of a simple autopoietic system; and look at the number, dimensions and complexity of the chemical reactions going on in it at a given instant. What mathematics can adequately cover them? And how many thousands of differential equations are required to express them? An autopoietic system can never be understood by a study, however intense, of each component of the system. Its properties and functions can be comprehended only by an understanding of the *interactions* between the components, that is, by a study of its dynamical organization.

Human Systems in Transition

This is complex, but the human organization is enormously more so. The complexity of structure and organization of modern human society exceeds that of any other biological system. It calls for a new mode of inquiry, beyond operations research, econometrics or applied mathematics. Human aspirations, human objectives, human ideals, are dynamic, complex, individual, and are constantly in conflict. And it is these very qualities that constitute the source of evolutionary unfolding of Man. Milan Zeleny and Norbert Pierre are forthright in their affirmation that human systems encompass the whole hierarchy of natural systems: physical, biological, social and spiritual. They are not amenable to methods of reduction. They are too complex for systems analysis or design. Their management is not cybernetics or information theory, or a theory of general equilibrium; optimal control theory or theory of conflict resolution does

not explain them. They cannot be simplified by the rigour of mathematical mechanics. Electronic circuitry, communication channels, feedback loop mechanisms are no help in their understanding. They are organic, dynamic manifestations of organizational autopoiesis. They are self-renewing, self-repairing, self-realizing systems, with ability to anticipate the future, to formulate objectives, to plan their attainment and to make decisions. They deal with humans. Human systems management is not merely interdisciplinary or multidisciplinary. It is vastly more; it transcends all disciplines.

Prigogine's principle of 'Order through Fluctuation' and the new field of non-equilibrium thermodynamics are as validly applicable to human society as to biological systems. We are moving towards a theory of self-organization of processes and structures, as Alistair Taylor points out in his essay. Our socio-cultural evolution is one of *transformation*. In the past, science and technology were the chief agents in changing the man–environment relationship. What is required in the future is a progressive reversal of these traditional roles. Science and technology must direct their attention to conserving the resources of the planet and managing our global ecology. At the same time new social institutions, new strategies and values in our cultures, are called for; invention of new and appropriate techniques to unlock the enormous, hidden, and hitherto untapped, creative potential of the human individual as well as of cultures and social groups.

Marney and Schmidt's historical presentation of the evolution of the scientific method, beginning with the *axiomatic* prototype of Aristotle and Euclid down to Copernicus, through the *empirical* one of Newton, Maxwell and Einstein, to the *constructural* prototype of modern science, provides a perspective for the contemporary modification of the scientific method, which may be called the *normative* prototype. A gradual relinquishment of quest for certainty, continuing accretion of cognitive controls and a maximization of freedom and scope are characters of this new trend. These are the essentials of man's commitment to his future policy—a policy of conscious, purposeful alignment with the processes of emergence.

Crisis and Creativity

No one knows the total potentialities of mankind. The transformation of human consciousness has passed through several levels, from cultural revitalization to creativity, outlined by O. W. Markely. In each case, a crisis in a human system calls for new ways of meeting it whether it is through revolution in science, heroic mythology or creativity. In each case, there is a transformation of consciousness, a *METANOIA*, leading to a new paradigm. Particularly important is the new emerging science dealing with consciousness that could contribute significantly to this new paradigm. Man has always striven towards attaining greater and higher levels of awareness, — of himself and of the external world, and of the relation between the two. He has not made much progress so far, certainly not in the West; for he has all along felt that the new tools he had devised were adequate. Feedback training, learning theory, etc., have produced limited results. It would now appear that these methods need to be combined with the older traditional methods of the East, — Meditation, Yoga, Kundalini, Pránáyáma, — to unlock rapidly the untapped potentials of the human mind, especially its creativity, and powers of healing.

The New Image

Here is the evolving image of man. It involves the recognition of the identity between man and his world, between microcosmos and macrocosmos, between *atman*, the reality within, and *brahman*, the true essence of reality without. It consists of a perennial search for the self-realization of this ultimate relationship and its unfolding.

Historically, three modes of perception and inquiry have dominated man's attempts to recognize, establish and integrate this relationship between himself and the world around him. Jantsch calls them (*a*) mythological, (*b*) rational and (*c*) evolutionary. In the mythological, man enters into a relationship with God. The dominant factor is *Fear*, specially fear of falling from Divine Grace. In rational inquiry, illustrated by the methods of science, the subject and object are separated from each other and *Certainty* governs. In the third, the evolutionary inquiry, the dominant factor is *Hope*; the subject and the object, *atman* and *brahman*, become integrated into a wholeness expressed in the Upanishadic *Tat Tvam Asi* (That Thou Art).

The future evolution of Man lies in a reestablishment of the three primal aspects of human unfolding, which the Chinese have called the Tao of the Earth, the Tao of Man and the Tao of Heaven. In Hindu terms, these rest in three primal values, *'Satyam, Sivam, Sundaram'*. The mythological and the rational inquiries have in the past made their contributions to human society and its evolution, but their relevance in the determination of the future image of man seems limited. It is the 'evolutionary' mode that holds hope for the future. Here is the great challenge: recognition of the totality of man and one-ness of the human race; self-realization and development of

the individual ; a holistic perception of life and an appreciation of the true essence of humanness. These call for a new effort, *superconscious learning*, equivalent perhaps to our *Sujnana*, a 'consciousness to change consciousness', a self-reflective approach, providing a sense of direction for cultural processes and a dynamic guidance for mankind reaching out into the future. It calls for the development of a new understanding of human systems as an expression of life, going beyond adaptation and stabilization in order to develop a new paradigm of self-realization through self-transcendence, which is an integral aspect of evolution ensuring qualitative change,—a new science of humanity.

This is not easy and might well cause disruption. But in the words of A. N. Whitehead quoted by Jantsch at the head of his introductory chapter : 'It is the business of the future to be dangerous..... The major advances in civilization are processes that all but wreck the societies in which they occur'.

INSTITUTION OF CHEMISTS (INDIA), ASSOCIATESHIP EXAMINATION, 1977

The Twenty-eighth Associateship Examination of the Institution of Chemists (India) will be held in November, 1978. The last date for Registration is 30th November, 1977. The Examination in Group A (Analytical Chemistry) is divided into the following eleven sections and each candidate will be examined in two of them according to his choice as approved by the Council, in addition to the General Chemistry including Organic, Inorganic, Physical and Applied Analytical Chemistry : (1) Analysis of Minerals, Silicates, Ores and Alloys ; (2) Analysis of Drugs and Pharmaceuticals ; (3) Analysis of Foods ; (4) Analysis of Water and Sewage ; (5) Biochemical Analysis ; (6) Analysis of Oils, Fats and Soaps ; (7) Fuel and Gas Analysis ; (8) Analysis of Soils and Fertilisers ; (9) Analysis Connected with Forensic Chemistry ; (10) Analysis Connected with Leather Chemistry ; (11) Analysis Connected with Textile Chemistry ; The Examination is recognised by the Government of India as equivalent to M.Sc. in Chemistry for purposes of recruitment of Chemists.

Further enquiries regarding this and for Membership may be made to the Honorary Secretary, Institution of Chemists (India), Chemical Department, Medical College, Calcutta-73.

INTERNATIONAL AWARD IN INDUSTRIAL HEALTH

Prof. S. H. Zaidi, Director, Industrial Toxicology Research Centre (ITRC), Lucknow, has been selected by the American Industrial Hygiene Association to receive Yant Memorial Award, for the year 1977, for his pioneering contribution in the field of environmental and occupational health. Professor Zaidi is the first Indian to receive this award in industrial health.

AWARD OF RESEARCH DEGREES

Utkal University, Bhubaneswar, has awarded the Ph.D. degree in Botany to (Miss) Bharati Behard.

Tamil Nadu Agricultural University, Coimbatore, has awarded the Ph.D. degree to Shri N. Natarajan and Sargunam Davis Peter.

M.S. University of Baroda has awarded the Ph.D. degree in Chemistry to Shri B. Vinayak Kamath and Shri George Kurian, V ; Ph.D. degree in Biochemistry to Shri Vishnu Prakash ; Ph.D. degree in Physics to Shri Rameshchandra Thakorlal Shah.

Karnatak University, Dharwar, has awarded the Ph.D. degree in Mathematics to Shri Kulkarni Krishnaji Hanumantharao.

Sri Venkateswara University, Tirupati, has awarded the Ph.D. degrees to Shri V. Sundara Raja (Physico) and to Shri P. Satyan (Zoology).

Sri Venkateswara University, Tirupati, has awarded the Ph.D. degree in Zoology to Shri A. V. Ramana Dikshitulu.