MODELING HUMAN SYSTEMS VIA DIALECTICAL ECOLOGY

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Dialectical methods have recently been gaining renewed prominence in the social and behavioral sciences in the United States, particularly in developmental psychology (e.g., Baseeches, 1980; Buss, 1979; Erikson, 1959; Riegel, 1979; Rychlak, 1976). Over about the same time period, ecosystemic theory has demonstrated considerable potential as a comprehensive framework for organizing knowledge of human behavior as well as highlighting convergence among disciplines that seek to understand human experience in its varied contexts (e.g., Fox, 1990; Keeney, 1983; Lovelock, 1979; Naess, 1989). Taken together, dialectics and ecosystemic principles can link mechanical, organismic, and social systems frameworks without destroying the integrity of each approach--thereby making it possible to creatively juxtapose structural, functional, process, and critical models of human behavior in a variety of contexts.

Some Definitions and Assumptions

(1) Dialectics here refers to developmental trans-form-ation in which things (systems) are constituted by the relationships between them (Baseeches, 1980; Weeks, 1986). Since the "self/world" (subject/object) nature of reality is both experientially and logically prior to all other characteristics, it is the basis for both ontology and epistemology (Tillich, 1951).

(2) Ecosystemic theory focuses on human transactions with both physical and social environments, thereby including transformational dynamics of

matter, energy, and information--all of which are important to a truly comprehensive understanding of human experience. In dialectics, the only constants are the processes by which systems maintain themselves. Therefore, all parts of a transactional field are interdependent through their common participation in an ecosystem.

(3) Any given system is a subsystem to other systems that include it and an ecosystem to the systems that comprise it. Systemically, dialectics points to the transactions of systems with one another involving continuous transformation--processes that constitute them as both subsystems and ecosystems. Therefore, the fundamental unit of reality is the subsystem/ecosystem dialectic, or the "system-in-transformation," and the primary focus of study is the transformational pattern.

Characteristics of Systems

Though systems can be said to have numerous "properties" and to operate according to a wide variety of principles, four primary ontological elements reflect the fundamental subsystem/ecosystem dialectic:

(1) Power and control are essential to the existence of subsystems/ecosystems, and to the relationship between them. Power can be conceptualized as the capacity of a system to influence other systems in its environment by being a system; correspondingly, control is the capacity of a system to limit the influence of other systems by being that particular system. The power/control dialectic reflects the functional process of "bounding" systems; that is, distinguishing them from one another while at the same time relating them to one another in particular ways designed to preserve ecosystemic autonomy and integrity. The tension between power and control in ecosystems reflects the need for ecosystemic functioning that produces a higher order equilibrium to assure its survival (Bateson, 1972; Ford & Ford, 1987; Schwartzman, 1984).

(2) Another basic dialectical principle is reflected in the relationship between "structure" and "organization" in systems (Maturana & Varela, 1987). Ecosystemically, structure refers to the everchanging patterns of relationship between subsystems in an ecosystem, while organization refers to the stable, integrated identity pattern of an ecosystem constituted by the relationships of its subsystems.

(3) An inherent tension exists between an ecosystem's stability (organization) and the continuous structural change of its subsystems' relationships. Given the recursive nature of systems, changes in the relationships among subsystems will affect the stability of a larger ecosystem (Bateson, 1972; Dell, 1982; Schwartzman, 1984). At the same time, the maintenance of any ecosystem will inevitably lead to the disintegration of certain subsystems. That is, the organization of any given subsystem may be destroyed in the service of positive structural transformations in the larger ecosystem.

(4) A dialectical relationship between order and chaos exists in all ecosystems. The exact course of historical events in complex dynamic systems is unpredictable (Gleick, 1987; Maturana & Varela, 1987; Peitgen & Richter, 1987). Numerous circumstances occur in which subsystems in an ecosystem that are sufficiently distant or indirectly related to a given subsystem will, over time, undergo transformations sufficient to produce a different environment for that given subsystem. That subsystem will respond by altering its patterns of interaction with other subsystems. If unable to do so, the system will organizationally disintegrate. From the standpoint of that system, these events are random. Yet they are permitted by the organization of the ecosystem and are part of a restructuring of this ecosystem in line with its evolutionary adaptation.

The dimension of history (i.e., space/time configuration) is fundamental in dialectics, since it is in history that being is actualized. Ambiguity characterizes the relationship between being and becoming, and therefore also the relationship between subsystems within an ecosystem. Significant existential issues arise from the ambiguity of studying living systems in their historical context. These questions point to the realm of ethics as well as to philosophy and science. They raise the matter of what Bateson (1972) termed the relevant "units of survival" in ecological systems.

The key issue for systems under the conditions of life is that of "ecological balancing," the process of transforming subsystem/ecosystem relationships so as to maintain existential viability through interdependence. These transformations must occur without either losing the structures of interdependence between the subsystems or destroying the overall organization of the ecosystem. In complex dynamic systems, these transformations can take many different forms; specific events and outcomes are impossible to predict. Ecological balancing encompasses the equilibrial tendencies of mechanical systems, both homeostatic and morphogenic principles of organismic systems, and the striving of social systems for viability (survival with meaning) in the life process (Buckley, 1967; Speer, 1970). It reflects the total interdependence of all systems and ecosystems on a continuous basis--the universe as a living, autopoetic system: "Gaia" (Lovelock, 1979).

On the basis of the analysis summarized above, there are four criteria against which the success of ecological balancing can be judged. To the observer, these appear as emergent characteristics, or "properties," of viable systems. All are interdependent, overlapping, and complementary:

(1) autonomy - the capacity of any given system to operate as a self-regulating entity, reflecting correspondence between the system's operations and its design (Ford & Ford, 1987; Nesselroade & Ford, 1987).

(2) coherence - the extent of congruent interdependence in functioning whereby all aspects of an ecosystem fit together (Dell, 1982; Ford & Ford,

1987);

(3) adaptability - the relative degree of change occurring in the internal structural relations of a system as part of its interactions with other systems, within the ecosystem to which all are subsystems (Bateson, 1972; Maturana & Varela, 1987);

(4) flexibility - the range of ecosystemic conditions over which a system can function effectively without organizational disintegration (Gleick, 1987).

The more complex a given system, the more diverse its transactions. Its internal structural relation s are enriched, with greater opportunity for variety in the transactions among them. However, this adaptability may exist at the expense of coherence in the system and/or flexibility of the system within its ecosystem, and/or it may create structural transactions that eventually become dysfunctional for the ecosystem. The more complex a system within its ecosystem, the greater the number of its transactions with other subsystems. However, this flexibility may be achieved at the cost of some coherence and/or adaptability and/or function. Less complex systems reflect greater coherence, but may gain this coherence at the expense of positive functioning and/or adaptability and/or flexibility. The relative restrictiveness of systemic processes may limit their impact on the operations of the larger ecosystem. In addition, if conditions in their larger ecosystem change sufficiently, these systems are likely to be threatened by an inability to interface with other subsystems which may have become relevant to their survival in the ecosystem, rendering them dysfunctional.

There are no universal standards for levels of functioning in systems. To permit the survival of any designated subsystems and their ecosystem, transactional patterns must be necessarily and sufficiently autonomous, coherent, adaptable, and flexible to meet prevailing conditions at a designated time.

Principles for Modelbuilding

From this approach to dialectical ecology emerge a number of guiding principles for the development of human relationship theory and the construction of transactional models. Space permits only brief explication of the most important of these.

First, transformational patterns are the basic units of observation; therefore, subsystem/ecosystem relationships are the primary "building blocks" of any descriptive or explanatory model of human relational phenomena (e.g., Gottman, 1982). While this complicates theory development, it also permits a more precise designation of complex systemic phenomena to fit within the framework of General Systems Theory. In addition, concepts and principles that are both dialectical and ecological facilitate movement between the three categories of systems--mechanical, organismic, and process (Buckley, 1967).

Second, all theoretical constructs are framed dialectically. Dialectical bipolarity permits the juxtaposition of linear and circular concepts, creating more encompassing descriptions of transactional phenomena, for example, the concept of power/control. Admittedly, the multidimensionality of dialectical constructs can itself contribute to confusion (Kolb, 1984). However, in the view taken here, the extra effort to construct theory dialectically is worthwhile in return for the more comprehensive and precise explanations of relational phenomena (Ford & Ford, 1987; Lerner & Ford, 1992).

Third, the emphasis is on dimensional analysis that examines the manner in which human systems vary in certain patterned ways rather than classifying them into artificially constructed "types." Dimensional analyses explicitly acknowledge that the numbers and names of dimensions can vary on the basis of heuristic criteria. Dimensions that claim to be "fundamental" simply enjoy the advantage of widespread consensus as to their utility. The approach outlined here permits one to identify a variable number of dimensions, depending upon the nature and purposes of the transactional model being constructed, as well as the accessibility of data.

Fourth, this approach points to a different way of depicting--and, possibly, of quantifying--human systems phenomena. A geometric aspect is at least implied in all theory construction. To date, two-axis graphs and "wiring diagrams" borrowed from cybernetic models have been used most extensively to illustrate human behavioral patterns. Three-dimensional depictions are particularly well-suited to integration with the emerging models characteristic of contemporary science and mathematics (e.g., Fuller, 1975; Fox & Long, 1990).

Admittedly, three-dimensional models of dynamic ecosystems imply complicated methods of measurement, complex formulas, and computer-based techniques of analysis. However, such methods of analysis are becoming increasingly available to researchers on human relationships (e.g., Fox & Long, 1990; Lavee, 1988; Nesselroade & Ford, 1987), and there are some promising developments in mathematics utilizing various alternative topological models (Gasson, 1983; Hofstadter, 1985; Schumm, et al., 1989). Triangles, tetrahedral polygons, and spheres have been shown to be intimately related in topological modeling and other synergistic approaches to science that are concerned with patterned expressions of interconnections between the natural world and human experience (c.f, Epstein, 1988; Lerner & Ford, 1992; Wilber, 1985).

Finally, rather than producing a single, and undoubtedly controversial, "unified theory," this approach leads to a network of interrelated models of structure, function, and process that are logically consistent, conceptually complementary, and pragmatically useful. The concepts of human systems, such as "family," become ecosystemic phenomena whose various dimensions can be delineated and examined from multiple perspectives that need not be exclusive of each other. Although certain epistemological assumptions are implied in the approach, ideological arguments need not predominate. Rather, they can be accommodated within the context of certain "generic" concepts and principles, such as "ecological balancing."

Conceptually refining, operationalizing, and interrelating various dimensions of human experience are complex and time-consuming tasks. Data-gathering and analysis in ecological models are also complicated endeavors, requiring careful attention to detail, inter-individual and intra-individual aggregation of data, combinations of qualitative and quantitative approaches, utilization of time-sampling methods, careful selection of research designs, and innovative statistical programs (Dogan & Rokkan, 1969; Nesselroade & Ford, 1987). Nevertheless, imaginative approaches to model construction, along with careful empirical verification, can result in improved understanding of human interaction dynamics that will have a variety of worthwhile applications.

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