Evolution, Order and Complexity

Edited by
Elias L. Khalil
and Kenneth E. Boulding

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EVOLUTION, ORDER AND COMPLEXITY

Evolution, Order and Complexity reflects the current interest in the relation between the natural and the social. Its central concern, running through all the contributions in this collection, is a desire to overcome the nature/society dichotomy and to move beyond the sterile debate between anti-naturalists and crude naturalists.

Against neo-Darwinian theories, the contributors argue that the complexity of both social and natural phenomena precludes reductionist and mechanistic modes of analysis. As the chapters in this volume demonstrate, it is indeed possible to explore the relations between, and the unity of, the social and natural worlds without reducing one to the other.

Evolution, Order and Complexity brings together specialists in biology, ecology, philosophy, economics, neuropsychology and other fields to give new impetus to the dialogue between natural and social scientists. Together they show that the two branches of science are not mutually exclusive, but are part of a complex continuum.

This is a bold and challenging book; its scope and its often insightful conclusions make it required reading for both natural and social scientists.

This volume is one to the last projects initiated and coordinated by **Kenneth E. Boulding**, late Professor Emeritus of Economics at the University of Colorado at Boulder. Boulding was one of the founding fathers of general system theory and wrote numerous books throughout his prolific career. **Elias L. Khalil** is Assistant Professor of Economics at Ohio State University and Visiting Scholar at the University of Chicago.

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Michael Perelman

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Dedicated to the memory of
Kenneth Boulding

CONTRIBUTORS

Kenneth E. Boulding (d. 1993) sometime Distinguished Professor of Economics, Emeritus, University of Colorado at Boulder; author of *The Structure of a Modern Economy: The United States, 1929–1989*, 1993.

John H. Campbell Associate Professor at School of Medicine, UCLA, Visiting Professor at Oxford University and the Australian National University; editor of *Creative Evolution*, 1993.

Vilmos Csányi Professor and chair of the Department of Ethology, a member of the Hungarian Academy of Sciences and the International Union of Biological Sciences Commission for Education; serves on the editorial boards of *Acta Biologica Hungarica*, *Life and Science*, and *World Future*; author of *Evolutionary Systems and Society: A General Theory of Evolution*, 1989.

Jean-Pierre Dupuy Professor of Social and Political Philosophy, Director of Research at CNRS at the Ecole polytechnique, Paris, and Department of Political Science, Stanford University; author of *Introduction aux sciences sociales, Logique des phénomènes collectifs*, 1992.

Niles Eldredge Chairman and Curator of the Department of Invertebrates, American Museum of Natural History, New York; author of *The Miner's Canary: Unraveling the Mysteries of Extinction*, 1994, and *Reinventing Darwin*, 1995.

Hermann Haken Professor Dr. Dr. h.c. mult. of Theoretical Physics at the University of Stuttgart; author of *Information and Self-Organisation*, 1988.

Hubert Hendrichs Professor Dr. of Ethology at the University of Bielefeld; author of *Lebensprozesse und wissenschaftliches Denken. Zur Logik der Lebendigkeit und ihrer Erstarrung in den Wissenschaften*, 1988.

Elias L. Khalil Assistant Professor of Economics at Ohio State University; author of several articles; recipient of the Alexander von Humboldt Research Award for 1995–96.

Henri Marie Laborit (d. 1995) sometime Professor and Director of the Laboratoire d'Eutonologie at Hospital Boucicaut; recipient of the Albert Lasker Prize of the American Public Health Association and the Anokhine Prize of Academy of Sciences, USSR; author of *Les Récepteurs Centraux et la Transduction des Signaux*, 1990.

Howard H. Pattee Professor of Systems Science and Director of Graduate Studies, T. J. Watson School of Engineering, State University of New York at Binghamton; author of "Measurement-Control Heterarchical Networks in Living Systems," *International Journal of General Systems*, 1991.

Karl H. Pribram Professor Emeritus, Stanford University, James P. and Anna King University Professor and Eminent Scholar, Commonwealth of Virginia; author of *Brain and Perception: Holonomy and Structure in Figural Processing*, 1991.

Gregory B. Stock Visiting Senior Fellow, the Woodrow Wilson School of Public and International Affairs; author of *Metaman: The Merging of Humans and Machines into a Global Superorganism*, 1993.

Robert E. Ulanowicz Professor at the Center for Environmental and Estuarine Studies Chesapeake Biological Laboratory; recipient of the Frederocj C. Hettinger Memorial Award (1964); author of *Growth and Development: Ecosystems Phenomenology*, 1986.

Milan Zeleny Professor of Management Systems; recipient of the Georg Cantor Award, Erskine Fellowship, Alexander von Humboldt Research Award, and Norbert Wiener Award; serves on the editorial boards of *Computers and Operations Research*, *Future Generations Computer Systems*, *Fuzzy Sets and Systems*, *General Systems Yearbook*, and *Human Systems Management*; author of *Autopoiesis, Dissipative Structures and Spontaneous Social Orders*, 1980.

PREFACE

At the last stage of preparing the manuscript, Kenneth Boulding fell ill. After a long bout with cancer, he passed away on 18 March, 1993, at the age of eighty-three, at his home in Boulder, Colorado. This has left many friends and colleagues with a great void. Although he left behind him over forty volumes and eight hundred articles, people who came to know him closely, to feel his vivid excitement over big ideas and the little things in life, and to note his diligent work towards world peace realize that he died prematurely.

The idea of the volume was born out of a conversation with Boulding at the 1990 meeting of the Society for the Advancement of Socio-Economics at George Washington University in Washington, DC. Two themes emerged from the conversation. First, how amazing that so many diverse forms (ranging from human to nonhuman entities) in nature are, at deeper levels, similar in one way or another. The casual observation of uniformity differs greatly from the drive which informs much of neo-Darwinism. Namely, neo-Darwinians generally start with the notion of how amazing that entities in nature are so different from each other.

Second, most social scientists (the orthodox as well as the heterodox) uncouple most human phenomena from nature. They assume that natural forms are commanded by external and given forces which do not allow intentionality, the role of habits, and the relevance of context. Such an assumption leads, put simply, to the presentation of nonhuman natural phenomena as no different from the artificial realm with includes tools and machines. Boulding and I agreed that the dichotomy should not be penciled along the social realm, on one hand, and the natural realm understood as articificial, on the other. Rather, the dichotomy should be drawn along the social and natural realms, on one side, and the artificial, on the other.

So we invited contributors to write essays which challenge one of the most trenchant assumptions in modern social and economic theories, the natural/social dichotomy. The essays should add a unique voice to an expanding choir calling for the relevance of natural sciences (both physical and biological) to the study of human action, cultural institutions, and social

organization. The essays do not attempt a systematic treatment of such a vast topic. It is hoped that the different contributions would converge into a broadly defined intellectual space which would facilitate greater dialogue between natural and social scientists. The contributors, in different ways, argue for the pertinence of the naturalist approach on the bases that the organism is creative, capable of learning, and that its behavior is somewhat context-dependent – very much what most social scientists have stressed about the supposed uniqueness of human behavior.

The thesis that human behavior is unique has informed a great number of methodological positions in the social sciences. Such a thesis is usually contravened by old-style crude naturalist contentions like the ones touted by most sociobiologists. The main character of the contributions here is that they, implicitly or explicitly, criticize the autonomy-of-social-science thesis, but without falling back on crude naturalism. They do not reduce social phenomena to some given genetic information or map them according to supposed mechanistic laws. Rather, the contributors generally argue that natural dynamics and biological entities are as complex as higher level social dynamics and organizations. The complexity perspective may elucidate the unity of social and biological phenomena without resorting to reductionist and mechanistic accounts.

The idea of complexity promises to supersede the barren debate between biological determinism and social determinism. The contributions try to show how biological and social processes are isomorphic. To put it metaphorically, cultural schemes and social organizations could be seen as biological phenomena at a higher level, while biological taxonomic traits and organizations could be viewed as sociocultural phenomena at a lower level.

We would like to invite social scientists to take a fresh look at contributions offered by maverick biologists and others that promise to open new vistas beyond the sterile debate between anti-naturalists and crude naturalists. Boulding had the chance to read and comment on all the invited chapters. Unfortunately, he was not able to work on the organization of the volume. I would like to acknowledge the help of two anonymous readers, the editorial team at Routledge, Vivian Wilson and Thomas Foster, as well as the technical assistance of Carole Brown, Patricia Markley, and Yolanda Allen.

E. Khalil

INTRODUCTION

In the first chapter, "Social theory and naturalism: An introduction," Elias Khalil attempts to defend naturalism understood as the natural/human continuity thesis. First, he distinguishes naturalism from crude naturalism in order to avoid diverse misuses of biological metaphors and, hence, eschew the strong reservation which deconstructionists, ranging from Michel Foucault to Mary Douglas, have expressed towards naturalism. Second, he delineates between two radically different orders: chaotic order as typified by ecosystems and markets, on one hand, and organizational order as displayed by organisms, firms, and states, on the other. Third, he maintains that there are, at least, three different strains of non-crude naturalism related to organizational order: First, "metaphysical naturalism" entails that nonhuman organisms are, in varying degrees, as intentional/purposeful as humans. Second, "phenomenist naturalism" maintains that institutions and taxonomic traits define the identity (nature) of the agent and, hence, are assumed in everyday decisions or neo-Darwinian adaptation. Third, "ontological naturalism" regards social organization as an individual and, hence, cannot be reduced to the strategies of members which could extend to the genome level.

The following chapter, "Interfacing complexity at a boundary between the natural and social sciences," is by Karl H. Pribram. Pribram's concern with complexity is part of the ontological problem of the relations among the different levels of hierarchy. He starts with the behavioral account of Skinner who recognizes two gaps which, according to Skinner, only brain science can fill. The first gap is between the environment and the stimulated behavior. The second gap is between the consequences of behavior and the resulting *change* (the problem of memory). For Pribram, the first gap allows us to argue that as much as the environment has a pattern which "affords" the organism to perceive it (à la Gibson's ecological theory of perception), the organism has a predisposition to select its environment. Furthermore, the second gap allows us to maintain that the resulting change is not a mere reaction to traces of memory, but rather the memory is organized in a way which encourages change in a certain direction.

Pribram summarizes numerous experiments in his laboratory and others which confirm the ways he fills the two gaps, viz., particular neural cells are actively selecting and organizing (tuning). The experiments show that neural processes resulting from stimuli could be described as Fourier holographic-like frequencies where the inputs are transformed into patterns which can be modeled, as suggested by D. Gabor, as sets of convolutional integrals. Gabor used the mathematics of Heisenberg's quantum approach which he also applied earlier to measure the minimum uncertainty of communication among persons. Thus, put simply, the same quanta mathematics about information may account for behavior at the particle, neural, and person levels. This suggests that to understand the brain/behavior relationship and fill the gaps recognized by Skinner, we need to invoke data from both the environment and neural levels. It seems that invariant, deep information identity – which underpins cross-level processes – holds the key for superseding the brain/mind dichotomy. The primacy should be attributed neither to the mental nor to the neural – nor for that matter to equal division between them. Rather, processes at both levels are the instantiations of, or informed by, the same quanta of information à la Gabor's elementary functions. At the end, Pribram reflects on the ramifications of the cross-level isomorphism of the invariant, Platonian-like quanta information with regard to the free will/determinism problem.

In his chapter, "The autonomy of social reality: On the contribution of systems theory to the theory of society," Jean-Pierre Dupuy argues that the contemporary theories in logic, cognitive science, artificial intelligence, and game theory have bearings on fundamental issues in the humanities and the social sciences. He puts a special emphasis on the logic of self-reference, the paradoxes of reflexivity, and the challenge of the notion that autonomy implies the essential incompleteness of any human or social totality. Dupuy argues that it is impossible to conceive self-sufficiency in the human world. He contrasts structuralists like Lévi-Strauss and deconstructionists like Derrida. While Lévi-Strauss resorts to cybernetical metaphors to account for incompleteness, Derrida shows how structures fall prey to a kind of vicious self-referential logic referred to as the "logic of the supplement." Dupuy argues that, to start with, we should not use cybernetic metaphors. Instead, we should employ the theory of complex autonomous systems. This promises, according to Dupuy, to clear up at least some of the most famous paradoxes like the leader, panic in Freud's theory of the crowd, and the notion of self-transcendence in Hayek's theory of spontaneous social systems.

In his chapter, "Ultra-Darwinian explanation and the biology of social systems," Niles Eldredge contends that sociobiology is not weak only with reference to human behavior, but also with regard to nonhuman behavior. Its general weakness is derived directly from underlying difficulties in orthodox biological evolutionary theory which exclusively emphasizes

reproduction (fitness) success. On the basis of a hierarchical approach, he equally emphasizes the economic (interaction) aspect of organismic behavior. Thus, the chapter raises the issue of context and hierarchy of organization. The hierarchy, according to Eldredge, arises from reproductive activities of local population (demes), themselves parts of the largest system in which reproductive adaptations are shared (species). In contrast, economic behavior leads directly to the formation of local interactive populations (avatars) which are parts of the ecosystem. While reproductive activities generate genealogical hierarchy, economic interactions constitute ecological hierarchy. According to Eldredge, the fault of orthodox Darwinism is the stress on the primacy of reproductive activity (via fitness maximization criterion) over economic interaction.

Contrary to common perceptions, in his chapter "The complexity of social and mental structures in nonhuman mammals," Hubert Hendrichs shows that each mammal has unique mental characteristics. Furthermore, it has psychological qualities which cannot be completely explained by genetic dispositions. The qualities develop while the animal is growing up in close contact with several conspecifics, exploring possible ways to act in a network of highly complex relations. Thus, the chapter complements Eldredge's discussion of "economic" interaction. Hendrichs describes the socialization of a mammal as learning the rules of behavior and how to handle conflicts. What is most amazing is that the rules vary across groups of the same species. This indicates that culture is not uniquely human.

Milan Zeleny in the chapter "On the social nature of autopoietic systems," challenges implicit and dormant assumptions. The question should not be whether human organization is similar to the organism, but rather whether biological organization resembles social organization. He appeals to Francisco Varela's approach, called autopoiesis (self-production), in order to substantiate his thesis that cells and organisms should be studied as societies. Zeleny's thesis has implications with regard to the metaphysical question of whether there is no radical divide between human and nonhuman organizations.

In his contribution, "Organization, function, and creativity in biological and social systems," Vilmos Csányi complements Zeleny's approach, and its metaphysical ramifications, by drawing attention to the systematic nature of the biological and social evolutionary systems. He argues that Darwinian theory just looks for the changes of the components (lineages of descent) as does the neo-Darwinian agenda with the genes. Similar to Eldredge's thesis, Csányi maintains that both lineages and genes are important actors in the evolutionary theater. However, they are components of a higher system which needs to be attended. For Csányi, we need to study the structure, the constraints, and the degrees of freedom of the system as a whole. Csányi is ultimately interested in accounting for creativity in biological and social systems. He summarizes and extends

his replicative component systems model. He argues that the proposed replicative model is capable of accounting for genetic mutation and evolution.

In their chapter, "Human society as an emerging global superorganism: A biological perspective," Gregory B. Stock and John H. Campbell draw further similarities, along ontological lines, between social organization and biological organization. They argue that modern industrial society – with its machines, domesticated plants and animals, and physical infrastructure such as buildings and highways – is becoming a cohesive global entity that has a physiology with close analogs to the circulatory, nervous, and digestive systems of animals. According to them, the dynamics of modern society can no longer be adequately understood by viewing humanity merely as a highly social species embedded in an extended planetary ecosystem. Rather, it is becoming a superorganism. An outstanding aspect of the emerging global superorganism is its ability to evolve rapidly. This is the case because, first, it has internalized natural selection so that its component parts and systems can compete aggressively among themselves. Second, it has further honed the evolutionary process by developing the power to build abstract models and plans which compete vigorously for future implementation.

In "Neurological and social bases of dominance in human society," Henri Laborit provides a stern assessment of the modern predicament. He argues that in order to understand human behavior, it is important to know how the central nervous system operates. One of the principal functions of the brain is to effect relationships among humans. In this sense, he exposes the ontological role of context or interaction for neural functioning. One of the activities of the brain, according to Laborit, involves centralizing information on the normal or disturbed operation of the cellular ensemble of the organism as well as on the environment. In this manner, the organism learns through reinforcements. The property concept arises from reward learning and how, in the quest for dominance, this leads to competition among individuals and groups. In modern society, the symbols of dominance have become more abstract. The quest after such symbols engenders stress and its associated pathological disorders. Thus, as much as modern man eludes himself to be free, he is in fact a prisoner of fabricated hierarchical systems which push him further towards non-reflective conformity.

Robert E. Ulanowicz, in "The propensities of evolving systems," starts with Karl Popper's recent book, *A World of Propensities*. Popper lends his pen to the anti-Cartesian view that the world is not a deterministic clockwork. This calls for an extension of our concept of causality beyond the confines of efficient and material agencies. For Ulanowicz, this is an opportunity to show that ecosystems are chaotic, i.e., far from transforming along deterministic pathways. However, that does not mean they do not generate patterns. Ulanowicz offers a calculus which could quantify propensities

and may lay out the ground for a theory of transformation towards greater ecological ascendency.

In "Synergetics as a bridge between the natural and social sciences," Hermann Haken articulates how synergetics is an inter-disciplinary field of research which deals with systems composed of many parts that may produce spatial, temporal, or functional structures spontaneously. That is, it is capable of self-ordering in dynamical and organizational senses. The general principles are illustrated by means of applications to physics (lasers), biology (human finger movements), computer sciences (parallel networks for pattern recognition), and, in particular, to sociology. He demonstrates how a great variety of phenomena may be described by means of general concepts such as stability and instability, order parameters, and the slaving principle. Given such common principles, he argues for the unity of the sciences.

Howard H. Pattee maintains in "The problem of observables in models of biological organizations," that physical theories have come to be the epitome of models for all levels of complexity, including living organizations. However, the observables are simpler and observer-independent in physical theories compared with biological and social theories. Also, while observables in physical theories could be separated from measurement devices, this is not the case in biological and social theories. Pattee discusses the inadequacy of the physical model paradigm for discovering the significant biological observables and for modeling human organizations that are complex enough themselves to be observers and modelers of their world. He explains why concurrent, distributed networks now used to model cognitive activity, could prove to be complementary for modeling strongly interconnected, observer-dependent living organizations. While Pattee sees a divide between physical and living sciences, he argues for a continuity between biological and social sciences.

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