Nonlinear Dynamics, Psychology and Life Sciences

ISSN 1090-0578

http://www.societyforchaostheory.org/ndpls/

Vol. 11, No. 1, January 2007

Special Issue:
Paradigm Shift of Normal Science?

CONTENTS AND ABSTRACTS:

Abstract: *Thomas Kuhn (1957, 1962) explored the issues of paradigm shifts, scientific revolutions, and the relationship between them. Written before the techniques and practices of the complexity sciences were developed, Kuhn described what he termed the Copernican Revolution as the last scientific revolution signifying a paradigmatic shift in society. We will explore whether New Science approaches in nonlinear dynamics and complexity research signify postmodern science perspectives, and examine the role of New Science in what may be the on-going evolution of the next paradigm shift.*

Abstract: *If epistemology is about what we know and how we know what we know (what is inside) and ontology is about what there is to know (what is outside) then the most fundamental challenge that complexity makes is that these can no longer be considered as separable. Traditional science was based on the idea that there was an objective reality outside, and that we could study it and do experiments on it that allowed us to build, cumulatively, an increasingly accurate picture of that reality. Whilst for simple physical problems, and for planetary motion, this was a reasonable working hypothesis, for biological and social systems this has always been a problem. Experiments are not repeatable or transferable, and situations are historically evolved involving local, co-evolving contexts, and therefore can potentially all be unique and lacking in any generic behaviours or laws. Complexity science brings us face to face with this elusive reality, and tells us that we must accept uncertainty, and admit that our cognition, our descriptions and our models are necessarily incomplete and temporary props to our current functioning. They help us make some sense of the past and the present, and are all we have to help us in taking steps into the future. Examples of these ideas will be given for ecological, social and economic systems, showing that models, despite their necessary incompleteness, can still be useful in clarifying and living with some of the real uncertainties we have, and in this way can help us explore possible futures. However, complexity also tells us that we need not limit our explorations to those suggested by our models, since they are necessarily incomplete, and that we should also indulge in "creative actions" in order to find out more about what might happen, and in this way both increase our possible choices of action, and also improve the scope of our models.*

Abstract. *The application of theories of complexity to the study of cognition has only recently started but it has already caused high expectations and controversies. Currently an extensive evaluation of the theoretical status of these theories does not exist. In an attempt to fill in that gap, this text develops a meta-theoretical analysis that presents a reconstruction of the theories of complexity applied to cognition, establishing their theoretical status, conceptual cores, basic assumptions and explanation strategies. Freeman's theory of cerebral chaos will be analyzed first. Then a meta-theory generalization to neuro-cognitive theories will be presented. It will be sustained that the central theoretical core of cognitive complexity theories are based on the metaphor of the mind, the brain or cognition as a dynamic system, founded a time-space topology. The framework of this study is based on ontology of processes and an ontological pluralism. The explicative strategies are supported by emergentistic approaches and nomological derivation based on mathematical laws. The prototypes of the theory are strongly backed up by computer simulations. This paper concludes by suggesting the existence of two antagonical perspectives (universalistic and pluralistic) in the core of these theories.*

pp. 91-117

The Emergence of Leadership in Coordination-intensive Groups

Stephen J. Guastello, and **Robert W. Bond, Jr.**, *Marquette University*

Abstract: *Although group coordination was introduced to psychology in the early 1990s, it was not until the advent of nonlinear dynamical systems (NDS) that it was possible to gain an understanding of how the process of implicit learning and self-organization take place in conditions where no hierarchical (management) influences are involved. This experimental study examined how leaders might emerge from coordination-intensive task groups where verbal interaction is not possible. NDS and game-theoretical research indicate that the presence of leaders is not required to produce coordination. Thus the question remains as to whether leaders would emerge from coordination-intensive task groups in the similar manner to how they emerge from other types of groups. In the experiment, 13 4-person groups were allowed to discuss the coordination (card game) task while performing it; 13 other groups worked nonverbally. Split-plot ANOVA showed that verbalizing groups performed better than nonverbalizing groups overall and showed more acute coordination learning curves. Nonlinear regression for temporal dynamics within verbalizing and nonverbalizing groups showed asymptotic stability for initial coordination learning and transfer to a coordination rule of equal difficulty, but a chaotic function was observed when the teams switched to a more difficult coordination rule. A questionnaire measured leadership emergence at the end of the game along with other social contributions to the groups' efforts. The average level of leadership emergence for individuals did not differ between verbal and nonverbal conditions, although differences in other social contributions were observed. This experiment illustrates, furthermore, how the nonlinear science paradigm produces new hypotheses concerning verbalization that would not have been formulated otherwise. New avenues of study concerning coordination, leadership, and hierarchies are also discussed.*

pp. 119-147

Do Nonlinear Dynamics in Economics Amount to a Kuhnian Paradigm Shift?

Mohammed H.I. Dore, *Brock University*
J. Barkley Rosser, Jr., *James Madison University*

Abstract: *Much empirical analysis and econometric work recognizes that there are nonlinearities, regime shifts or structural breaks, asymmetric adjustment costs, irreversibilities and lagged dependencies. Hence, empirical work has already transcended neoclassical economics. Some progress has also been made in modeling endogenously generated cyclical growth and fluctuations. All this is inconsistent with neoclassical general equilibrium. Hence there is growing evidence of Kuhnian anomalies. It therefore follows that there is a Kuhnian crisis in economics and further research in nonlinear dynamics and complexity can only increase the Kuhnian anomalies. This crisis can only deepen. However, there is an ideological commitment to general equilibrium that justifies "free enterprise" with only minimal state intervention that may still sustain neoclassical economics despite the growing evidence of Kuhnian anomalies. Thus, orthodox textbook theory continues to ignore this fact and static neoclassical theory remains a dogma with no apparent reformulation to replace it.*

pp. 149-165

Process and Meaning: Nonlinear Dynamics and Psychology in Visual Art

Tobi Zausner, *The C. G. Jung Foundation*

Abstract: *Creating and viewing visual art are both nonlinear experiences. Creating a work of art is an irreversible process involving increasing levels of complexity and unpredictable events. Viewing art is also creative with collective responses forming autopoietic structures that shape cultural history. Artists work largely from the chaos of the unconscious and visual art contains elements of chaos. Works of art by the author are discussed in reference to nonlinear dynamics. "Travelogues" demonstrates continued emerging interpretations and a deterministic chaos. "Advice to the Imperfect" signifies the resolution of paradox in the nonlinear tension of opposites. "Quanah" shows the nonlinear tension of opposites as an ongoing personal evolution. "The Mother of All Things" depicts seemingly separate phenomena arising from undifferentiated chaos. "Memories" refers to emotional fixations as limit cycles. "Compassionate Heart," "Wind on the Lake," and "Le Mal du Pays" are a series of works in fractal format focusing on the archetype of the mother and child. "Sameness, Depth of Mystery" addresses the illusion of hierarchy and the dynamics of symbols. In "Chasadim" the origin of worlds and the regeneration of individuals emerge through chaos. References to chaos in visual art mirror the nonlinear complexity of life.*

pp 167-182

Commentary on Paradigms and Key Word Index for *NDPLS* Articles 1997-2006

Stephen J. Guastello[1], *Editor-in-Chief*

Abstract: *Although a paradigm shift in the sense of a postmodern worldview might be taking shape in society at large, the core concepts of nonlinear science date back a century, and are only tangentially influenced by other intellectual developments. Relative to contemporary science it offers new concepts concerning events that transpire over time, new hypotheses, new methods for answering new questions, some efficient answers, and a new perspective for understanding what we do not know in addition to knowing how we*

know what we know. Paradoxically, nonlinear science can be viewed as a narrow specialty within a specific discipline and as a general systems theory that identifies common themes that underlie phenomena found in a wide range of disciplines and specialties. The key word index illustrates the breadth of concepts and applications found in NDPLS, and some pathways for continued growth of the field.