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Society for Chaos Theory in Psychology & Life Sciences

**Abstracts to the
15th Annual International
Conference, Denver, CO**

2005





2005 CONFERENCE

SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY & LIFE SCIENCES

August 4-6, University of Denver, Denver, CO

PROGRAM ABSTRACTS*

Listed Alphabetically by First Author

Where Chaos Dissolves

Susan Aaron, University of Toronto

Nonlinearity functions in a world view where boundaries are defined by such terms autopoiesis as a continual exchange between organism and environment. Persons and their environment, and indeed their engagement with a world are thus defined by this interchange in the world. Thus a worldview is created where boundaries are often the cultural norm. Nonlinear as a broad and nonmathematical concern relates to patterns, or social even perceptual constructions that are relatively loose or non-structured comparatively within this relationship. One can apply the concept of chaos to return us to order as an opposite of it. I am suggesting that perhaps we may never lose order or have a methodology in the world that exists more dynamically than the separation of individual and environment. We are actively engaged as a world participant but apply certain constructs to divide up the actions of a world, to what end and at what loss? I propose a discussion and a demonstration of art, technology and ecology and

communication in relation to space that considers the need or not need of formation of boundaries relative to the individual's actions in the world. Here space is a cultural label rather than a guaranteed entity. In so doing I hope to consider how cultural constructions as framing or creating order exist. Likewise, alternatives that move beyond structures to interactivity in the perceptual creation of a worldview are considered. Those using notions of nonlinearity can review how they hold and manipulate structures and boundaries.

Aesthetics and Fractal Dimension of Electric Sheep

Ralph Abraham, Univ. California Santa Cruz, Fred Abraham, Blueberry Brain Institute, Scott Draves, Spotworks, Clint Sprott, Univ. Wisconsin Madison, Pablo Viotti, Univ. California Santa Cruz

Physicist Julien Clinton Sprott demonstrated a correlation between aesthetic judgments of fractal images and their fractal dimensions (1993). Scott Draves, a.k.a. Spot, a computer scientist and artist, has created a multidimensional space of two-dimensional colored fractal images called fractal flames, based on chaotic attractors of two-dimensional iterated function systems, and an algorithm that expands a flame into a brief animation called an electric sheep. His website, electricsheep.org, serves electric sheep to a large community of regular users, via the sheepserver, through a highly interactive client, a screensaver, involving generation of new sheep by both server and users. The users vote electronically for the sheep they like while the screensaver is running. In this report we proceed from Sprott to Spot. Data from Spot's website show significant correlations between aesthetic judgments for flames and their fractal dimension, similar to reports by colleagues of Sprott using his images. Presently, we are studying the variation of this correlation and the favorite fractal dimensions with time, to determine if there are similarities or differences in the evolution of aesthetic preferences with respect to fractal dimension as Taylor has found in the evolution of Pollock's art (2003).

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Toward a General Theory of Cognitive Thermodynamics

Malcolm Dean, Author, journalist, independent scholar,

Einstein refused to blame Gravitation for people falling in love, but he cautioned that Thermodynamics "is the only physical theory of universal content which...will never be overthrown." By the mid-20th century, thermodynamics was established in Communication Theory, but without adequate tools, initial enthusiasm for Thermodynamics in human communication waned rapidly. Recent advances in complexity science, Bayesian theory, and the neurosciences raise old questions: What would cognitive thermodynamics look like? What are its implications? Based on a general theory of Information, we present a simple model of cognitive systems and discuss the challenges a Thermodynamic worldview presents in science, culture, religion, and (contemporary Western) philosophy. Previous working papers in this series were presented to the Cognitive Affinity Group, UCLA, and the Society for the Scientific Study of Religion. Malcolm Dean is an author, editor, and a former Principal Editor at UCLA.

Problem Ecologies & Regulatory Accretion: Habits that Pass for Dynamics

Linda Dennard, UCC/ETHOS

Problem ecologies and regulatory accretion: Habits that pass for dynamics Linda Dennard ETHOS The habits of public organizations in adapting to their own regulations creates complicated layers of regulatory accretion reflecting a lack of understanding by administrators of the dynamics by which a broad system of political and social relationships extends itself. While going about the business of problem-solving according to administrative and regulatory protocol, public agencies often create adaptive conditions for citizens in which individuals play a role as either victim, problem, or interest that is a patterning of bureaucratic culture in larger arenas of society in the emergence of problem ecologies organized by what is not working in the system. In particular, administrative structures seek a coherence that is natural to administrative logic, but dysfunctional for more diverse environments and for individuals. Administration tends to outscale in this sense creating complexity that is both unsustainable and that also appears disconnected from any purpose other than the survival of the regulatory environment - but which successfully patterns in the rest of society, creating bureaucratic and often hostile cultures, with recurring but regulated problems such as poverty and crime. The problem however of administrative accretion is not resolved by cutting regulations (agencies simply adapt) or by further reform (again agencies tend simply to adapt) but by (1) making administrators aware of what they are asking society to adapt to and (2) by seeking knowledge/resources from outside administrative frameworks as organizing principles for action. The ETHOS project efforts in this regard are described.

Complex Dynamics at Work: OD Theory and Practice

Glenda Eoyang, Human Systems Dynamics Institute,



The field of organization development (OD) is relatively new, with roots that go back to the 60s and 70s. Almost any tool, methodology, or technique that can be used to shift individual or organizational understanding or behavior has been embraced by OD. The missing component for the field, however, is a coherent theoretical framework that is accessible to and accepted by practitioners across the discipline. Past efforts to establish a solid theoretical base for OD have modes of intervention. The effect has been that each of these efforts has just added another to the plethora of OD methods without creating a theoretical base that can be shared across current methodologies. Our question is whether or not the nonlinear sciences can inform a solid and resilient theoretical foundation for OD. Such a theory base must apply to all existing OD practices, articulate the differences among them, explain when and how they can be complementary to each other, and identify gaps that need to be filled with innovative OD practices. In this paper, we will examine five widely accepted OD methodologies (large-scale technologies, sociotechnical systems, T-groups, live system simulations, and team building). We will use the CDE Model of self-organizing in human systems, which derives from nonlinear sciences, to describe the underlying dynamics and the ways each method shifts those emerging dynamics. Based on our findings, we will recommend further questions to inform development of theory and practice in the field of OD.

Do Tell: Sharing A Chaotic Vision

Mark Filippi, Director, The Extended Self Program

Everyone who walks the nonlinear path carries a vision for how this plays out in their life and the lives of others. Sometimes it pays to go back to the point of origin and get some perspective about the journey so far. Whether you came upon chaos theory from a scientific, artistic or philosophical portal of entry, at some point the concepts took root in you and proliferated. When considered from a cultural standpoint, chaos theory gets re-told in many forms and in different lights. In reviewing my own personal experiences, examining the trends in pop culture and finally distilling the salient features of the current research, several provocative discontinuities have materialized. I will be focusing on

the dynamics in the vibrant field consciousness studies. Participants will be given the opportunity to fill out a checklist that will review some of the authors, directors, bloggers, politicians, and celebrities who have been referencing chaos theory in the media in forms that are accessible to casual users of the internet since our last conference. The idea behind this informal exercise is to illustrate how pervasive and loose the boundary conditions for expanding the relevance of chaos theory are in contemporary society. Whole technologies are embracing and advancing what was once the sole province of the expert. By getting a sense of our baseline recognition of this phenomenon, I intend to use this feedback to show how a discontinuity is manifesting around the subject of consciousness studies. Out of all the possible topics, this one seems to best illustrate the spectrum of visions people hold for the future of chaos theory as a meme for others to carry. I'll explore the next steps in this process.

Cultural Change Supports Healthcare Improvement: Implications for Social Marketing Efforts Frank Funderburk, InCompass Systems

Changes in shared beliefs, expectations, perceptions, norms and patterns of reciprocal behavior among individual agents who interact with one another are sometimes broadly referred to as a cultural shift. The concept of culture has been linked in the literature to various aspects of organizational and small group performance including measures of team coordination (e.g., Guastello et al., 2005), membership dynamics (e.g., Arrow et al., 2000), therapeutic support (e.g., Rubinfeld, 2001; Burlingame et al., 1995), business unit profitability (e.g., Dennison, 1984; Fisher & Alford, 2000), organizational quality and safety (e.g., Dooley, 1997; Guastello, 1988; Zimmerman et al., 2001). Many of the tools, metrics, and heuristics developed for the study of cultural or organizational change processes from a nonlinear dynamic perspective have direct relevance for improving healthcare delivery systems. This paper will explore some of these issues. Key points of the presentation include: The social phenomena typically referred to as culture can be characterized rigorously by a variety of experimental and interactive modeling approaches that reflect the basic principles of complex adaptive systems. These models can help to explain seemingly counterintuitive results of many failed efforts to produce sustainable healthcare quality improvement. A variety of approaches have been suggested, but each of the models to be considered seemed tuned to a distinct set of healthcare issues. An overarching theme is that the structure of the networked agents has an important role in setting limits on the nature of the change that can be sustained. Self-organization of social networks, which can guide the expression of the cultural change produced, suggest ways that health promotion and social marketing efforts could be enhanced.

Identifying the Emergence and Convergence of Patterns Foundational to Mental and Social Disorder

Jaclyn P. Gisburne, Neural Therapist in Private Practice, CO

The purpose of this paper is to introduce five conceptual and contextual patterns foundational to understanding both mental and social disorder. These patterns emerged from a systematic convergence of the general principles and functions of grounded theory and complexity (chaos) theories. In this paper the author will explore how these five insights can provide a unique framework in which to better understanding the dynamics of mental disorders, including but are not limited to: (a) how mental and social disorders are adopted; (b) the conditions under which adoption takes place including role of risk factors; (c) the transitional and instability indicators observable in the adoption process; (d) the role and significance of development and risk factors on individual mental health phase portraits (e.g., DSM-IV diagnosis) and behavioral trajectory, and (e) congruencies between fractal functions in individuals, collective behavior under stress, and regional conflict. The author's research perspective, methodology, and findings have direct impact on prevention and intervention program development, efficacy, and intervention failure.



Captivity in Spouse Complaints to the Police as a Measure of Dependability of the Authorities: Regional Comparison

Hilik Goldstein & Michel Sonis, Bar-Ilan University, Israel

This paper deals with the measurement of the authorities' dependability in Israel. The state authorities' ability to introduce expectations for positive intervention into family decision-making is an important indicator of society's confidence in the authorities. The spread of this confidence can be regarded as a socio-spatial process of diffusion of the captive alternatives of social choice. It is important to stress that the degree of penetration of captive alternatives of individual choice cannot be presented as a measure of social correctness of such a choice. The central part of this paper presents an analytical description and a numerical method of the measuring the captivity of spouse complaints to the police on the level of six official police districts during the period from January 1998 to December 2001.

Emergence, Self-transcending Constructions, and a Metaphysics of Hope

Jeffrey Goldstein, Adelphi University

The phenomenon of emergence in complex systems hinges on the possibility that what is radically novel comes into existence. Radically novel in this sense refers to the characteristics of unpredictability and nondeducibility from lower level or antecedent components as well as irreducibility to this lower level. If such emergent phenomena actually exist, however, this poses a serious challenge to reigning versions of reductionism including those sundry metaphysical positions that claim radically novel entities and properties cannot come to be. In addition, although it might be thought that postmodernism, as, in part, a reaction against scientism and its accompanying reductionist mechanism, upon further scrutiny postmodernism can be understood as holding a species of reductionism in its failure to imagine the possibility of the radically novel appearing in the world. That is, postmodernism can be shown to share a similar nihilism along with modernism regarding the possibility of radical novelty. In this paper, I will lay out how emergence can be understood as a challenge to the nihilistic underpinnings of both modernism and postmodernism. This will include a critique of Heidegger's idea of Transzendenz as lacking any genuine Transcendence. In its stead, I will offer a metaphysics of hope based on understanding emergence according to the framework of self-transcending constructions. I will also discuss my view of emergence in relation to modern theologies of process, themselves stemming from earlier ideas of emergence. Emergence will be offered as a critical element in an exposition of the new nature of nature.

Leadership Emergence in Coordination Intensive Groups

Stephen Guastello & Robert W. Bond, Jr., Marquette University

The process by which an initially leaderless group differentiates into one containing leadership and secondary role structures was found to be aptly described by the swallowtail catastrophe model and principles of self-organization in previous research (NDPLS, 1998, 2(4), 303-316; NDPLS, 2000, 4(1), 113-120). A subsequent study identified the control variables in the process of leadership emergence in creative problem solving and production-oriented groups (NDPLS, 2005, 9(3) forthcoming), which were found to be different in the two cases. The present study examined a different case of coordination-intensive groups. Coordination-intensive groups are particularly interesting because it is known that coordination can occur without talking and without leaders present, even though talking helps in some respects (NDPLS, 2005, 9(2), 175-208). Participants (N = 104, group size = 4) played a coordination card game in which 13 of the groups were not allowed to talk to each other, and 13 groups were allowed to talk. After playing the game, the participants rated each other on leadership behavior, styles, and variables related to the process of conversation. Participants could identify no one as the leader or contributor of particular conversational remarks. Ironically, the levels of leadership emergence were equivalent in both verbal and nonverbal groups. A swallowtail catastrophe model was obtained here also, showing that the three control variables were: a broad range of task participation behaviors, whether the group worked verbally or nonverbally, and behaviors specific to task control. The study also represents a convergence between two independent lines of nonlinear dynamics research in group processes.

A Nonlinear Model for Type 1 Diabetes

Tim Holt, Clinical Lecturer, Warwick Medical School, UK

Chaos theory is illuminating both the conceptual framework and the research methodology of the life sciences, particularly at the interface between psychology and physiology. The author has developed a nonlinear model for blood glucose variation in type 1 diabetes, both to assist in clinical care and as a research tool. People living with this condition benefit from maintaining blood glucose levels close to normal, through improved quality of life and reduced long term complications. However tight control risks hypoglycemia, in which the level may fall dangerously low. Replacing the missing physiological regulation mechanism with adaptive decision making strategies is a major challenge. Increasing evidence highlights the value of patient-centered approaches with support from practitioners. But how do we define normal dynamics, when traditional physiological modeling assumes an underlying equilibrium state? And how do we translate the information arising from frequent blood glucose monitoring into effective patient-centered decision making? A number of models have been developed, including the author's chaotic control strategy, which recognizes that the psychological and behavioral elements regulating blood glucose levels in type 1 diabetes cannot be separated from the physiology, and that nonlinear interactions between blood glucose determinants produce an under-recognized source of unpredictability. The advent of frequent monitoring devices, which are now creating more adequate blood glucose datasets for time series analysis, may allow us to define healthy dynamics using nonlinear indices, including Lyapunov exponents, correlation dimension, and multiscale entropy. This paper will explore the implications for clinicians, patients and researchers.

The Method in Their Madness: Chaos Theory and the D.C. Snipers

J. Suzanne Horsley, PhD Student, UNC-Chapel Hill

This paper explicates chaos theory from a social science perspective. Using the Washington, D.C., area sniper shootings in October 2002 as a case study, this paper unravels chaos theory in terms of a public crisis that required a response from government officials. The series of events, which spanned the country and lasted for several weeks, were initially thought to be isolated crimes. However, the major characteristics of a chaotic system were in place: a nonlinear pattern, the generation of positive feedback, the occurrence of bifurcation points, and an elusive strange attractor. Each iteration of the shootings differed in the target, location, and time of day, and the only apparently consistent characteristic was a single shot fired by the same weapon. In addition, officials misinterpreted the scale of the series of events, with incorrect guesses ranging from a case of terrorism to a single suspect living in the D.C. area, while looking for the wrong vehicle all along. The paper concludes by discussing the implications of this case study for public sector crisis communication. As we all know, hindsight is 20/20, but some of the communication missteps taken by law enforcement and other government officials can serve as lessons for public communicators who find themselves dealing with similar crises in the future.

Innovation, Information Seeking and Innovation Adoption: Facilities and Plant Managers Energy Outlook Comparing Linear to Nonlinear Models

Joseph Jacobsen & Stephen Guastello Marquette University

One focal point of concern, policy and a new research will involve identifying individual and organizational facilitative and obstructive factors within the context of energy innovation diffusion in the U.S. This interdisciplinary intersection of people, technology and change is one of serious consequence and has broad implications that span national security, energy infrastructure, the economy, organizational change, education and the environment. This study investigates facilities and plant managers' energy innovation information seeking and energy adoption evolution. The participants are managers who consume more electrical energy than all other groups in the world and are among the top users of natural gas and oil in the United States. The research calls upon the Theory of Planned Behavior, the Diffusion of Innovations and nonlinear dynamics in a study of adoption patterns for 13 energy-related innovations. Cusp catastrophe models and power laws were compared to linear multiple regression to examine and characterize data. Findings reveal that innovation adoption and information seeking differences are slight between private and public sector facilities and plant managers and that the group as a whole may resist change. Of the 13 innovations, 3 exhibit very strong cusp catastrophe distributions while moderate support for multiple linear regression and the power law were found. Control variables were attitude toward the energy innovations and organizational resistance.

Hopf Bifurcation and Structural Instability in an Open Economy with Keynesian Rigidity

Edgardo Jovero, Universidad Complutense de Madrid

This paper attempts to contribute to the debate in macroeconomic dynamics by presenting the neo-Keynesian challenge. Proof is presented regarding the behavior of an open-economy two-sector growth model in the neo-Keynesian tradition of non-market clearing. It has been shown that there possibly exists a Hopf-bifurcation type of structural instability in a nonlinear dynamical model of the macroeconomy by which a stable region is connected to an unstable region situated in a center manifold in the state phase of the resulting dynamical system. The Keynesian view that structural instability globally exists in the aggregate economy is put forward, and therefore the need arises for policy to alleviate this instability in the form of dampened fluctuations is presented as an alternative view for macroeconomic theorizing.

The Effects of Irregular and Missing Data on Lyapunov Exponent Calculation

David Kreindler, Dept. of Psychiatry, University of Toronto, Canada, & Charles Lumsden, Depts. of Physics and Medicine, University of Toronto, Canada

Lyapunov exponents are important invariant quantities used for characterizing the behavior of nonlinear systems: the presence of a positive maximal Lyapunov exponent is considered a strong signature of chaos. Normally, maximal Lyapunov exponents are calculated from long, regularly sampled time series. In the case of human self-report time series data, irregularities in sampling rates are common; furthermore, these irregularities are typically natural outcomes of the data generation process. Relatively little has been published to assist with the analysis of irregularly sampled data using nonlinear time series analysis techniques. We recently completed a study comparing the performance of nonlinear analytic tools on complete and patched sets, and concluded that powerful standard methods for characterizing attractors can be adapted to time series data even if only a subset of a regularly sampled series is available. In this paper, we report the results of a series of computational experiments on synthetic data sets designed to assess the impact of irregular time series data on Lyapunov exponent calculations. The behavior of a conservative quasi-periodic, a dissipative chaotic, and a self-organized critical dynamical system were sampled

regularly in time and the regular sampling was disrupted by data point removal or by stochastic shifts in time. Missing data segments were then patched by means of segment concatenation, by segment filling with average data values, or by local interpolation in phase space. Comparative results of Lyapunov exponent calculations will be presented.

Perturbations, Measurement, and Nonlinearity in the Social Interaction

W.F. Lawless, Paine University

A study by Department of Energy (DOE) of its Citizen Advisory Boards ("Boards") supported DOE's policy for consensus (CR) over traditional majority rules (MR), dismissing Board contributions to instrumental action (environmental remediation). But to support DOE's policy of CR, its study was confined to subjective evidence. In contrast, we proposed that social links between Boards and DOE sites affect cleanup. Field evidence disputed the claims in the DOE study but supported ours. We extended our findings to ANL's agent study (EMCAS) of electricity markets, also based on subjective data, with the field evidence again raising questions about subjectivity. The pursuit by researchers of subjective evidence raises a fundamental issue. We recognize that classical social information gives the appearance of being stable as if rationally constructed from an individual's perspective (Von Neumann & Morgenstern, 1953). However, the same is true if social reality is bistable or composed of two views with only one of the views collected as data (e.g., the old saying that "there are two sides to every story"). That is, the measurement of social or interdependent objects, like an organization, always produces classical information by breaking the interdependence that exists before the measurement, meaning that the collected data will be unable to recover the essence of a social object such as an organization (e.g., Levine & Moreland, 1998), what we term the measurement problem. It occurs when the nonlinear information contained within a social object or interaction is converted to seemingly linear, rational information during measurement. Thus, to measure social objects such as an organization, researchers must predict how the social object will react to a perturbation such as measurement. One such perturbation began when DOE called for an acceleration of the cleanup in 2002, including transuranic (Tru) wastes destined for the WIPP repository, NM. In response, DOE scientists and engineers developed 13 recommendations to accelerate the disposal of Tru wastes in WIPP. In 2003, these recommendations were submitted to representatives of the Boards for their approval. We predicted and found decisions by those Boards based on their decision structure and process (Lawless et al., 2005).

Individuation as a Chaotic Process

Krystyna Laycraft, The Center For Chaotic Studies, Alberta, Canada

The Individuation is an open-ended, nonlinear, dynamic and complex process of psychological maturity. According to Jung the individuation is the establishment of a right relationship between the ego - "who I think I am," and the Self - "all that I really am." Consciousness and the unconscious form a complementary pair of opposites, similar to order and chaos in the chaos theory. The tension of opposites generates psychic energy and facilitates psychological growth. Conflict, confusion and suffering are symptoms of the transition between the natural and the cultural phase. The psyche reaches a level of complexity at which it bifurcates into new and complex structure. During the second half of life the ego is affected by the shadow and the anima/ the animus archetypes. The insurgence of the shadow is part of corrective effort made by the Self to bring the personality back into balance. The anima, feminine psychological tendencies in a man's psyche, is responsible for development of creativity. The animus, male personification of the unconscious in woman, develops enterprising spirit, courage, truthfulness and creative ideas. The two - dimensional view of psychological development postulates an interface on which dynamics, common to all (diachronic). Art and verbal creativity are modes of the relationship between consciousness and the unconscious. Verbal creativity is a most important component in the process of individuation, by testing out our thoughts and feelings with others. Creativity is characterized by a psychological openness to interior and exterior experiences.

NeuroOccupation: The Nonlinear Dynamics of Intention, Meaning and Perception

Ivelisse Lazzarini, Creighton University

This presentation proposes revisiting and re-exploring the concepts of intention, meaning, and perception, which theoretically operationalize nonlinear brain dynamics and occupation. A review of theory and research suggests that intention, meaning and perception are instrumental to understanding the client's unfolding life experiences through a self-organized system. In describing the organization of the nonlinear dynamics of brain activity, it becomes apparent how intention, meaning and perception are the fundamental components of how human beings create meaning by engaging in self-directed and self-determined actions; hence, occupations. Through a fresh point of view and an improved understanding of the concepts intention, meaning and perception, occupational therapist and other rehabilitation practitioners may find common ground to integrate many diverse approaches into a more unified field.

Simulating Barter and Financial Economy

Sary Levy-Carciente, Central University Venezuela Klaus Jaffe, Simon Bolivar University

The influence of money creation is a key matter in economics. The goal of this work is to use computational tools to simulate societies of different levels of financial development in order to gain a better understanding of the dynamics underlying economic processes. We show that computer simulation of simple economic agents can generate a non linear dynamics that resembles real life features of known economic system, and that the type and nature of financial instruments is pivotal in the management of economic dynamics.

Differential Movement Patterns but not Amount of Locomotion in Open Field Behavior of an ADHD Animal Model: The Spontaneously Hypertensive Rat.

Jay-Shake Li, Chung Cheng University, Taiwan & Yi-Chen Huang, Chung Cheng University, Taiwan

Attention Deficit Hyperactivity Disorder (ADHD) is a heterogeneous group of behavioral disorders affecting around 5% of school children. Impulsiveness, inattentiveness and over-activity are presently regarded as the main symptoms of ADHD. The spontaneously hypertensive rat (SHR) is one of the most frequently used ADHD animal models. This is a strain that has been bred from progenitor Wistar-Kyoto rats (WKY). Although SHR shows ADHD-like symptoms in a variety of behavioral paradigms, its locomotion behavior in the open field paradigm has not been definitively identified as over-active. Previous studies indicated that some of the inconsistency regarding strain difference in behavior might be due to comparisons of SHR with WKY, which has been observed to show extremely passive behavior in several paradigms. It has been shown that the SHR has larger amount of locomotion activity in open field than the WKY; however, the comparison between SHR and Wistar rats failed to show significant difference. It has not been investigated whether or not open field behaviors of SHR and Wistar rats can be differentiated by the patterns of movements. In the present study, we compared among SHR, WKY and Wistar rats the temporal and spatial scaling exponents of locomotion in an open field. The analysis was based on the scaling hypotheses proposed by Paulus and Geyer that measures the temporal and spatial organization of movements. Our results indicate that the temporal scaling exponent of WKY rats differed significantly from that of SHR and Wistar rats, whereas SHR and Wistar rats showed significantly different spatial scaling exponents. We conclude that the open field behaviors of the ADHD animal model, SHR, can be differentiated by the patterns, but not, by the amount of locomotion activity.

Tarasoff Dilemmas and the Problem of Counterfactuals

Patricia Lipscomb, Seattle Psychoanalytic Society & Institute

The Tarasoff duty is a judicially (or in some cases legislatively) created legal obligation imposed on psychotherapists to take reasonable steps to protect third parties from dangerous patients. It seeks to avoid potentially lethal but possibly unlikely outcomes to some at the expense of lesser but nearly certain harm to others (e.g., stigma, loss of confidentiality, loss of liberty, etc.). As public policy it should be subject to exacting and ongoing scrutiny of its benefits to the public versus costs to affected patients. Yet such analysis is hampered in theory by the so-called problem of counterfactuals and other logical considerations and in practice by the fact that the obligatory nature of Tarasoff interventions under certain circumstances cuts off some ordinary avenues of scientific investigation. Regardless of how clinically informed, a decision for or against a Tarasoff intervention is ultimately neither a logically motivated choice nor an essentially clinical one but rather a practical exercise in signal detection and as such it reflects the individual clinician's biases with respect to a patient's individual's interests versus the (possibly) greater good. A clinical example illustrates theoretical and practical problems with the Tarasoff duty.

Crowd Behavior Modeling and Simulation

Jodinell Lyssy, CMI Research Assistant, AFRL/HEDR, Kimberly Thompson, CMI Research Assistant, AFRL/HEDR, Christina Hinojosa, CMI Behavioral Scientist, AFRL/HEDR

CB M&S seeks to incorporate groundbreaking behavioral data into a series of training modules for crowd management techniques used by today's fighting forces. These agent-based models will be used to predict the propensity for crowd gatherings, offer lessons learned from past occurrences, and give today's military an avenue for practical crowd behavior tendencies. Finally, these agents-based modeling variables will be transformed into usable data requirements for scenario rehearsals and validation on platforms such as OneSAF and JCATS currently being used by organizations such as the Defense Modeling and Simulation Office (DMSO). Additionally, CB M&S focuses on a variety of disciplines to achieve success. CB M&S centers on integrating multi-faceted programs that attempt to define keys to managing various crowds. CB M&S utilizes behavioral science, computer modeling and various cultures to identify what strategies military personnel should employ. Specific non-lethal weapon platforms are currently being examined, as CB M&S stands as an overarching umbrella for various non-lethal weapon systems.

Over the past year, CB M&S researchers have conducted numerous Institutional Review Board-approved real-time experiments. This poster will highlight FY04/1QFY05 efforts, and give a colorful overview of the present and future of the CB M&S program. Distinct information will be provided covering the experiments themselves, collaboration with organizations such as DMSO and HECO, as well as the latest on the procedures used to transfer real-time behavioral data into computer modeling and simulation.

Emergent Hierarchies in Perception

Thomas Malloy, Psychology, University of Utah

Mathematical models have formed a rigorous basis for defining emergence within the logic of the models. More problematic has been the mapping of mathematically defined emergence onto scientific phenomena. Bateson's difference-based epistemology can be simulated by a Boolean network model. Bateson proposed that taking differences in differences would produce emergent hierarchies of knowledge. Simulating this proposal, the Boolean model, by taking differences in differences, generates hierarchical categories of perceptual stimuli. The crucial result is that these model-generated categories correspond to human perceptual categorical judgments. Thus the model-defined emergence hierarchy maps to perceptual hierarchies. Three realms of description will converge on the concept of emergence: Batesonian epistemology, a Boolean model, and human perceptual experience. In this case at least, this convergence grounds model-defined emergence both to a broad epistemological framework and to human experience.

Resemblance in Morphogenesis

Thomas Malloy, Psychology, University of Utah

The resemblance of one form to another is a phenomenon of basic interest in perception. In a Boolean net model attractor cycles are coded as a sequence of state vectors (of 0 s and 1 s) easily expressible as visual forms. This expression corresponds to the idea of morphogenesis. Let the forms resulting from two attractor cycles be Parent 1 and Parent 2. Take two state vectors, one from each parent, and create a Child vector by splicing together half the 0 s and 1 s from one parent and half the 0 s and 1 s from the other to create a new state vector, analogous to gene splicing. Run the system starting from the new state vector. Under very broad constraints, the system will fall into a third, Child, attractor cycle, which expressed as a visual form will resemble both Parent 1 and Parent 2 while having its own unique form.

The Myth of Psyche Through Nonlinear Eyes

Terry Marks-Tarlow, Clinical Psychologist, Private Practice, CA, Training Faculty, Southern California Counseling Center

An aspect of nonlinear science in context is how new ideas fit into old systems. One context vital to the pursuit of meaning in psychology is ancient mythology. With historical precedents set by Freud, Jung, May, and Hillman, clinical practice is frequently guided by originating myths that supply root metaphors and narratives. This paper analyzes the myth of Psyche, derivation of our field's name psychology and its subject matter the psyche. Nonlinear wisdom emerges through several important themes: the necessity of living in the dark with chaos; the self-organizing quality of nature, both inner and outer; interpenetrating, fractal boundaries between self, world, and other; and the paradoxical essence of psyche, where only through separation and individuation can we open ourselves to love and vital interconnection with others.

Controlling Duopoly Chaos

Akio Matsumoto, Economics, Chuo University

The recently developing theory of nonlinear dynamics reveals that any economic model can generate complex dynamics involving chaos if its nonlinearities become strong enough. The main purpose of this study is to consider economic implications of generating chaos as well as controlling chaos in a Cournot duopoly model with unimodal reaction functions. An equivocal characteristic of economic chaos is demonstrated. From the long-run point of view, one of the duopolists can be beneficial, and the other harmful in the chaotic market in a sense that the long-run average profit taken along chaotic trajectories is larger than the one of the latter. Then this study applies two distinctive control methods, the adaptive control method and the pole-placement method to the chaotic markets, in order to show that putting control reverses the situation: the beneficial duopolist in the chaotic market becomes disadvantageous and the harmful duopolist advantageous in the controlled market. This implies that either way of generating chaos or controlling chaos is unable to make both duopolists happy together.

Stochastic Substrates of Animal Cognition

Christopher May, Psychology, University of California, Davis,
Jeffrey Schank, Psychology, University of California, Davis,
Sanjay Joshi, Mechanical and Aeronautical Engineering, University of California, Davis

Animals are paradigms of complex systems. Because complex systems are often resistant to simple decomposition, we took an analysis-by-synthesis approach by creating a robotic analogue of such a system, the Norway rat (*Rattus Norvegicus*). One signature of complex systems is that even seemingly simple behaviors become much richer upon further inspection. For example, in an open arena, rat pups exhibit thigmotaxis behavior, a tendency to move towards the direction of tactile stimulation. Consequently, rat pups follow walls and burrow in crevices. These behaviors were initially modeled with a reactive architecture implementing thigmotaxis. Surprisingly, behavior emergent from such simple control rules provided a poor fit with the animal data. More surprisingly, however, an architecture which randomly selected one of nine possible simple movements, produced behavior that 1) was remarkably non-random in appearance and 2) provided a far greater match to the animal data. The morphology of the robotic agent, in interaction with the parameters of the environment, constrained behavior such that it actually appeared to be goal-directed (e.g. following walls). In contrast to chaotic systems, in which statistical regularities underlie apparently random outputs, we here implemented a random control system that produced regular outputs. We discuss the implications of this for understanding animal behavior and cognition.

Beyond Averages: Extending Organization Science to Extreme Events and Power Laws

Bill McKelvey, UCLA Anderson School of Management

In power law functions the exponent stays constant whereas in normal exponentials the exponential varies. On occasion, deviation amplifying mutual causal processes among interdependent data points cause extreme events characterized by a power law. Power laws seem ubiquitous; we list 68 of them half each among natural and social phenomena. We draw a line in the sand between Gaussian (based on independent data points, finite variance and emphasizing averages) and Paretian statistics (based on interdependence, positive feedback, infinite variance, and emphasizing extremes). Quantitative journal publication depends almost entirely on Gaussian statistics. After noting that practicing managers live in a world of extremes, we draw on complexity and earthquake sciences to propose redirecting organization science. Conclusion: No statistical findings should be accepted into organization science if they gain significance via some assumption-device by which extreme events and infinite variance are ignored.

Complexity Theory and Postmodern Texts: Conclusion Does Not Imply Closure

Allison Reed Miller, English, Oxford University, UK

Due in part to its emergence within the same cultural moment, complexity theory resonates with postmodern theories and practices, and has many implications for postmodern literature. Taking the open-endedness of contemporary texts as my focus, I will argue that complexity theory helps us to understand the dynamics of these texts, shedding light on their frequently confusing, violent or otherwise troubled endings, while at the same time assuring us that total understanding will always remain elusive. The complexity framework itself, of course, reflects this incompleteness; and while it encourages a holistic perspective, it at the same time discourages a totalizing one. Complexity always leaves interpretation undone. Although this indeterminacy may represent a frustration to many in the sciences, to those of us in the humanities it suggests infinite possibilities for meaning. In applying a scientific model to literature, I want to avoid the impression that I am importing scientific thinking to help legitimize a project in the humanities. Far from it; much postmodern theory (especially Lyotard) argues that legitimization is only possible through local sites, and that overarching meta-narratives are outdated. We must be careful to avoid selling complexity theory as another such narrative that provides the key to universal truth and meaning a position that would reinscribe a kind of Newtonian order which complexity theory, by definition, rejects. At the same time, the sciences and the humanities, broadly and in specific settings, can enrich each other and offer insights that only the crossing of disciplinary boundaries can make possible.

Modeling the Margins of Complexity: Complexity Theory's Encounter with Postmodern Texts

Allison Reed Miller, English, Oxford University, UK

Among the diverse cultural sites that it has penetrated and changed forever, complexity theory can now count postmodern literature and criticism. This recent encounter impacts a variety of issues that concern literary studies, but also has wider implications. First, if language is a complex system (according to Paul Cilliers and others), then all literary texts must be complex systems too. But complexity can manifest itself at other higher levels of a text (including narrative content and structure), making some texts more complex than others. Complexity theory helps to articulate how these complex systems (texts) interact with other systems (readers minds) across porous margins as

they co-evolve in a larger, dynamic, signifying complex system called the reading process. These reading dynamics are particularly clear and forceful in postmodern texts which, due to semantic and/or temporal gaps, nonlinear organization, and heavy patterning, typically require a great deal of participation and adaptation on the reader's part. Taking the example of Donald Barthelme's short story, *Margins*, I will discuss the complex border between postmodern texts and their environment as well as the border between chaos and order within these textual systems. This complexification of traditional borders has several implications: if the text-world boundary is questioned, it affects the way we configure reality through narrative; if a reading dynamic that oscillates between order and disorder is considered the most adaptive, it affects the way we think about disorder in postmodern texts and the complex world they represent.

Bridging Science and Consciousness via Chaos, CAS and Homeodynamics

Daniel W. Miller, Clinical Psychologist, Private Practice

The purpose of this paper is to help to build a bridge between body and mind, science and consciousness, and to support a scientific basis for consciousness theory. We will offer an integration of scientific, chaos, CAS and consciousness studies, quoting supportive experiments and highlighting parallels between the disciplines. In that context, we will explore how the new concept of homeodynamics becomes the roadway for the bridge between body and mind. Many overlapping ideas exist. For instance, in Chaos, a crucial change in a system occurs at a bifurcation point at which a choice needs to be made whose outcome may determine the survival, functional effectiveness, or demise of the system. At the bifurcation an accumulation of energies derived from prior experiences have created a history that has become dysfunctional. Similarly, operations in consciousness with input from stores of unconscious memory, and with openness to external influences and internal needs, under stressful circumstances, brings a person to a critical choice point (a bifurcation). The system, structurally and mentally must make an advantageous choice that will make an effective change in the part-whole connections in the system. Consequently, the healthy psychophysiology of human organisms depends on the ability of psycho-structural components to effectively choose and facilitate change processes that affect its survival. Change in the human organism is critically dependent on internal communications, their responsiveness, and the mutual feedback between the body and consciousness variables of connectivity and, particularly, variables of the homeodynamic process that oversees and steers body-mind integration. Supportive experiments will be cited.

EEG Rhythms and Neurodynamics under Cell Phone Radiation

Tullio A. Minelli, CIRMANMEC-University of Padova I, Maurizio Balduzzo, University of Padova I, Madeleine Clifford, Imperial College of London GB, Francesco Ferro Milone, Day Hosp. Villa Rota-Barbieri-Vicenza-I, & Valentina Nofrate, Research & Innovation-Padova-I

Perturbations by pulsed repetition of the GSM signal on neuron cell membrane gating and calcium oscillations, at endogenous frequencies, have been suggested as a possible mechanism underlying activation of brain states and oscillatory EEG modes. To explain possible effects of GSM radiation on brain rhythms, EEG records have been performed with a cell phone operating, as usual, in touch with a temporal region. In the corresponding channels the signal overcomes from three to four times the basal EEG values while in the contra-lateral ones the artifacts result negligible. Dynamical systems with two equilibrium points and bifurcated can account both for the regularization of the alpha activity and for the low intensity required by subjective sensitivity, typical of the stochastic resonance tuning. Neuron circuitual models of this kind have been employed to reproduce the mentioned phenomenology. While the Hindmarsh-Rose model illustrates the stochastic resonance induced by a pulsate perturbation of near 1% the reversal potential or 5% the membrane voltage, more realistic simulations of cell membrane gating and calcium oscillations are in progress with the help of the Morris-Lecar, Dupont-Berridge-Goldbeter and Chay-Keizer nonlinear models.

Mental Representation about Concepts Using in Nonlinear Dynamic System Theory.

Olga Mitina, Moscow State University, Russia

In this paper results of experimental study will be presented. The study concerns mental representations about different concepts from Nonlinear Dynamic System Theory among researchers and students with different level of knowledge and experience in the field of NSD. Data were got using semantic differential technique. Subjects evaluate 24 basic concepts from NDS, among which Attractor, Catastrophe, Bifurcation, Repellor, Control parameter and so on, using 30 scales which concern understanding these concepts on different level: metaphoric, visual, formal and so on. They should answer from 1 to 7 the degree of their agreement how each statement scale fits different concept. Further analysis of these multivariate three-mode data shows us latent constructs helping people to use these concept in their copying with chaos and NDS and research it. Results may be interesting for teaching NDS, because help to integrate different latent constructs of understanding and make transition from one to another during learn period in students minds easier and faster.

Bad Apples: The Relationship between Individual-level and Group-level Dynamics

David Pincus, Department of Psychology, Chapman University, Orange, CA.

A series of experimental studies were conducted to examine the putative impact(s) of intrapersonal conflict on interpersonal processes during small group interactions. Groups of four female strangers were created and given the task of getting to know one another during a series of four 30-minute videotaped discussions. Each member completed questionnaires assessing perceptions of control, closeness, and conflict between each discussion. In the experimental condition, intrapersonal conflict was induced by providing false-feedback to one or more of the members indicating that the other members perceived her as cold and abrasive. In the control condition, no feedback was provided. Orbital Decomposition was used to identify recurring patterns within turns-at-speech among the members in the groups. The complexity of these recurring patterns for each discussion was calculated based on Lyapunov dimension, information entropy, and fractal dimension. In addition, the self-report measures of control, closeness, and conflict were used as covariates to predict changes in complexity across the discussions that were not related to the experimental manipulation. Finally, within-discussion changes in patterning (i.e., stationarity) were examined through a linear regression of the sequencing of high versus low recurring patterns over each 30-minute time-period. Results included significant reductions in the complexity of turn-taking patterns following intrapersonal conflict induction in some groups, drops and increases in complexity within some discussions due intrinsic group relational processes, and relative stability in complexity measures across discussions in the control condition. These results may shed light on the connections among internal psychological processes and group dynamics.

Dynamical Systems Theory and Pain Imagery: Bridging the Gap between Research and Practice

David Pincus, Department of Psychology, Chapman University, Orange, CA

This paper uses nonlinear dynamical systems theory as a framework for understanding the psychosocial etiologies of pain, and the ways in which guided imagery treatments may achieve their benefits in pain reduction. Individual factors and general systems models are reviewed, followed by a brief examination of results from treatment outcome studies on the use of imagery suggesting that nonlinear processes are involved in people's idiosyncratic responses to treatment. Next nonlinear concepts including fractals, complexity, bifurcations, and self-organizing processes will be discussed as they relate to pain processes. The intent of this discussion is to deepen, and at the same time simplify the clinical understanding of how so many causes and so many systems may interact to produce chronic pain. These nonlinear concepts might also provide a more satisfying explanation as to how imaginary mental processes can serve such a central role in a phenomenon as real and physical as pain.

Population of Easter Island, Modeled by Discrete Dynamical Systems

Michael Radin, Rochester Institute of Technology, William Basener, Rochester Institute of Technology
Bernard Brooks, Rochester Institute of Technology, & Tamas Wiandt, Rochester Institute of Technology

We will investigate the biology, the economics, history and the long-term behavior of solutions. In addition, discover opulence in the variety of dynamics that the system exhibits; in particular, periodicity, bifurcations and chaos.

Symposium on Bios

Hector Sabelli, Chicago Center for Creative Development, Arthur Sugerman, Chicago Center for Creative Development, Louis Kauffman, University of Illinois at Chicago, Lazar Kovacevic, Chicago Center for Creative Development

The Bios Data Analyzer (Sugerman et al, CD-ROM in Sabelli, Bios, a Study of Creation, World Scientific, 2005) is a collection of computer programs for the analysis of creative characteristics of time series data. Several of these programs calculate recurrences of vectors of different lengths in the time series, and compare them with recurrences found in randomized copies of the same data, while others investigate the change in statistical properties over time. Using these methods, we have identified unique creative features in physical, biological, and economic processes (International Journal of General Systems 29: 799-830, 2000, Kybernetes: 32: 692-702, 2003; Nonlinear Dynamics in Psychology, 7: 35- 47, 2003).

Bios and Chaos: similarities and differences. L. Kauffman, H. Sabelli, A. Sugerman and L. Kovacevic. University of Illinois at Chicago and Chicago Center for Creative Development. Chicago, Illinois, 60614. Here we will discuss a creative type of chaotic process, bios, characterized by diversification, novelty, and nonrandom complexity, features absent in chaotic attractors. Bios consists of aperiodic waves that display asymmetry, contiguity, diversification (increasing variance), episodic patterns (complexes), novelty (less isometry than their shuffled copies) and

nonrandom complexity, features that differentiate it from simpler forms of chaos. Unpredictability characterizes chaos; novelty characterizes bios. Biotic patterns are generated by a number of equations modeling bipolar feedback. They are also found in many natural and human processes that are intuitively thought of as creative. We thus regard bios as a prototype for creative processes. Significance of bios is that innovation in the pattern is produced in a causal, self-generating way, and not by random interactions like is the case with stochastic series. Mathematical experiments show that for the existence of bios, bipolar feedback is necessary; unipolar feedback produces only equilibrium, periodicity or chaos. Other conditions necessary for existence of bios include the presence of a conserved term. These experiments allow one to infer what conditions may foster or hinder creativity. This may have practical application in human processes, ranging from mental health to social health.

Creation Theory and the demonstration of biotic patterns in quantum and cosmological time series. H. Sabelli and L. Kovacevic. Chicago Center for Creative Development. Chicago, Illinois, 60614. Cosmological, biological and human evolutions demonstrate that natural and human processes are creative. Time series generated with the Schrödinger equation display novelty and nonrandom complexity. Cosmic background radiation shows novelty and arrangement but not other biotic features. Time series analysis of the distribution of galaxies recorded in two recent surveys (Las Campanas Redshift Survey, and the 2-degree Field Galaxy Redshift Survey) show a biotic pattern along the time-space axis, but not in the Right Ascension axis. These studies support the hypothesis that natural processes are causal and creative, and that bipolar feedback plays a major role in evolution. Evolutions are embryological-like developments: a small set of simple and deterministic principles creates complex and unique individuals and events. Bourbaki demonstrated that three "mother structures", lattice, group and topology could generate mathematics. Piaget discovered these same generators in the psychological development of children. Sabelli (Union of Opposites, 1989) proposed that lattice order (asymmetry), group opposition (symmetry) and topological transformation (spatial form) are embodied as action (energy flow in unidirectional time), cycling of energy and two-valued information, and material structure. Action and opposition generate chaos and bios, and presumably may also create higher levels of organization. These also contain these cosmic forms (self-similarity).

Bios and bipolar feedback in socioeconomic processes: scientific foundations for human emancipation. H. Sabelli. Chicago Center for Creative Development. As illustrated by the biotic patterns demonstrable in some economic series, social processes are creative and causal, rather than random or determined. Human action is thus possible and necessary. Scientific insight is desirable. We are developing theory and methods for human emancipation based on two concepts derived from our research: 1. Co-creation: biotic patterns are generated by positive and negative interactions between complementary opposites (co-creation bipolar feedback), at variance with conflict theories of change (Darwinian evolutionism, Marxist class struggle, and capitalist economics). (2). Biological priority and psychological supremacy: Human processes are co-created by the interaction of relatively simple physical and biological processes that have priority and greater energy, and complex (cultural and psychological) processes that acquire local supremacy with social and personal development. Neither material processes nor ideas have absolute primacy in human life, at variance with biological and economic materialism and with cultural and religious idealism. Health care, peace, and a healthy environment are political priorities around which to take the initiative, but to build a popular majority requires attending to collective (and diverse) cultural and emotional processes.

Multi-fractal Validation of Geographical Settlement Location Models

Roger Sambrook, University of Colorado, Colorado Springs

Concepts from the field of multi-fractals were used to evaluate two important geographical models of human settlement behavior; central place theory (CPT) and the Uniform random model (URM), both of which have been used extensively in the field of Geography to explain spatial distributions of human settlement. Box-counting and pair-wise methods were used to estimate the dimension of the set of points of the largest and that of the smallest cities of the United States. Estimates of fractal dimension differed for a given data set, depending on whether a box-counting or pair-wise calculation was used. These differences were explained by describing human settlement patterns as multi-fractal. The multi-fractal spectra of the largest and smallest US cities were compared. The set of larger cities had a lower dimension than small cities, reflecting the greater apparent clustering of major settlements, and greater heterogeneity of scaling, reflecting that the clustering of large cities was greater in some areas than others. Both patterns were subject to the same physical factors, thus controlling for factors such as relief or proximity to water. Estimates of dimension were lower for the real data than would be expected from a URM or CPT model of settlement indicating they are poor models for locational behavior. The heterogeneity of large settlements also indicates that simple uni-fractal models are probably unsuitable for settlement location modeling. The study concludes that CPT, URM and simple uni-fractal models are probably insufficient to describe or explain human settlement behavior.



A Multi-Modeling Approach to the Study of Modeling Complex Bio-behavioral Systems

Schank Jeffrey, Psychology, University of California, Davis; May Chris, Psychology, University of California, Davis; Joshi Sanjay, Mechanical & Aeronautical Engineering, University of California, Davis

I discuss a multi-modeling approach using computer simulation and robotic models for the study of sensorimotor development in Norway rat pups. I begin by discussing dimensions of modeling in this context and consider the question of whether robotic models are necessary for modeling behavior. Robotic models are a type of simulation model, but do they do anything that computer simulation models do not do? One reason often cited is that many physical variables influence the behavior of a physical system and it is difficult if not practically impossible to represent all of these with adequate laws or rules for physical interactions in a computer simulation. Another, and perhaps more important reason, is that the process of designing, building, and testing robotic models leads to new problems, discoveries, and interpretations precisely because one is working with a physical model. To illustrate this point, I will discuss examples and results of modeling individual and groups of rat pups with robotic models.

The Cantor Dust of Conflict

Meg Spohn, University of Denver, Denver, CO

SCTPLS Annual Conference August, 2005 22 From the classic Cantor Dust, we understand that noise in data transmission tends to scale in a precise pattern. As described by Gleick in his classic book, a common representation of the Cantor Dust is a representation of a transmission with noise in, for example, its middle third, in a scaled iteration down to the bits. Similarly, the intensity of human conflict, as measured by battle deaths over time series, seems to follow scaling patterns not unlike the Cantor Dust, with its own pattern of terrible bursts and terrible silence. War is often described by the soldiers who were there as being composed of short periods of intense violent conflict interspersed with longer periods of quiet tension or tedium. This project examines these patterns, and considers some of the questions that must necessarily accompany them: With a descriptive pattern, what are the risks inherent in forecasting, ethical, philosophical, and otherwise? What are the human and policy implications of potentially using such a pattern, or of allowing it to be used?

Nonlinear Hypotheses in Education Research Methodologies

Dimitrios Stamovlasis, Education Research Center, Ministry of Education, Athens, Greece

The rapid changes of today's world present new challenges on our educational system. Education research dealing with a complex and continuously changing system may not be able to provide the proper support by implementing conventional linear, qualitative or quantitative, approaches. NDS theory and the science of complexity might provide more solid foundation for understanding and decision-making. The present work explores the applicability and the usefulness of Catastrophe Theory for testing nonlinear hypotheses in educational research. Cusp catastrophe models are proposed, which accounts for discontinuities in students' performance. These models implement psychometric variables from neo-Piagetian theories or information processing models, as controls and demonstrate nonlinear interactions between students' mental resources and mental tasks. In addition, cusp catastrophe is tested in others education research areas implementing other behavioral variables such as students attitudes and choices, or teachers selection in workforce recruitment. Measurements were taken at two points in time, and the data analysis involved dynamic difference equations and statistical regression techniques. The nonlinear models proved to be superior to the linear counterparts, and that shows the limitations of statistical modeling used so far in education. Utilizing nonlinear methods and making the paradigm shift realized in behavioral science, seems promising for education and pedagogy. This work demonstrates the feasibility of providing empirical evidences for nonlinear processes in education research, which will build bridges between NDS-theory concepts and pedagogical theories.

The Multidimensionality of Health: Tools, One to Estimate the Status of Health and Another One to Evaluate Therapeutic Goals

Karl Toifl, Neuropsychiatric clinic, Medical University of Vienna

Based on a definition on illness and health, Which includes both individual bio-psycho-social complexity and dynamics of development, two tools will be presented, which are developed to be used in daily clinical practice. The first one should make possible to show the relationship between the estimated levels of the amount of demands a person is confronted with, the effectiveness of strategies to deal with these demands and the actual status of health. The second tool allows in daily clinical practice on one hand to document the multidimensional diagnostic and therapeutic process and on the other hand to evaluate the therapeutic goals. This tool supports the process of permanent qualitative improvement of diagnosis and therapy.

Sense and Practical Use of Tools to Estimate the Status of Health and to Evaluate Multidimensional Bio-psychosocial-therapeutic Goals

Karl Toifl, Neuropsychiatric clinic, Medical University of Vienna

In this workshop should be demonstrated and discussed the necessity and possibility of a multidimensional diagnostic and therapeutic approach to deal in the best way possible with the complexity and dynamics of individual states of health. In open discussion the sense and practical use of two tools, which should support the establishment of such a multidimensional approach should be demonstrated. The first tool allows the estimation of multidimensional demands, the effectiveness of strategies to deal with these demands and the state of health. The second tool allows the evaluation of individual therapeutic goals based on a multidimensional diagnostic process.

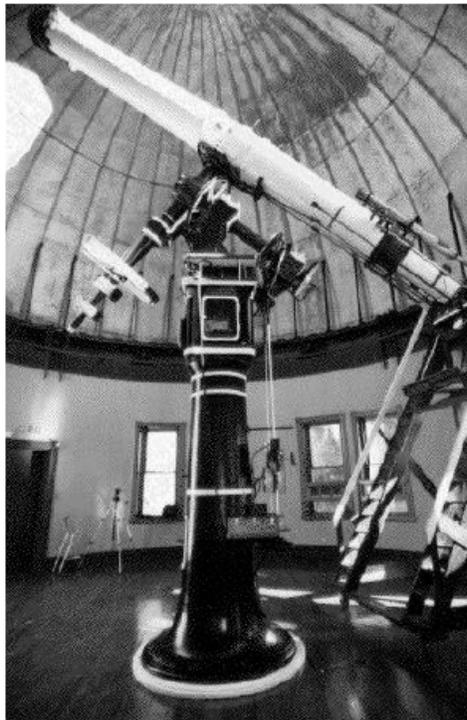
Chaos Theory, Metaphor Processing And Complexity

Rita M. Weinberg, Psychology-National-Louis University

Although the ubiquity and power of metaphors are well known, we still work to understand how our brains process such figurative non-literal language. Chaos theory provides insight into this aspect of brain processing, which describes a path from chaos to self-organization. Cognitive psychologists propose that metaphoric understanding involves taking two seemingly dissimilar things and finding similarities between them. They then map these similarities from the source that we already know to the target (new information). The outcome differs from both source and target. Metaphors can be understood at various levels of complexity. From chaos theory perspective, metaphors reflect two parallel systems, each stable in their own right. Mapping across destabilizes each system, leading to entropy and an emergent self organizing system. This re-organization produces new insight consciously or unconsciously. Metaphoric meaning produces different perceptions, reframing or a solution to a problem. One metaphor can alter perspective, attitude, self concept, motivation learning and behavior.

PLANETARIUM VISIT

Our visit to the Chamberlain Planetarium is scheduled after the banquet and guest speaker on Friday, 5 August.



KEYNOTE SPEAKERS

Neural Self-organization and Processes of Emotion

Marc Lewis

Cognitive neuroscientists portray the brain as a computational device for transforming inputs to outputs. In contrast, dynamical approaches model the brain as a self-organizing system that converges to attractors in response to perturbations. Though much improved, this picture is still half complete. Brain activities have to stabilize in order to do their work, but they do so only in the service of emotion. Emotional states emerge through "vertical integration" across the levels of the neuroaxis, including brainstem structures that mediate basic drives and packaged responses, limbic structures that attach emotional significance to events, and cortical structures that modulate and regulate feeling and action. The mechanisms responsible for this integration are intrinsically dynamical and they all play a part in the consolidation of emotion. They include the nested feedback architecture of neural circuitry, the global effects of neuromodulators and neuropeptides, emergent phase synchrony across cortical, limbic and brainstem structures, and the top-down coordination described by Haken's circular causality. Emotional states arising from neural integration capture cognition and action in the moment, but they also drive synaptic changes that underpin personality formation. Thus, stability in real time and stability over development are both outcomes of self-organizing neuroemotional states.

Marc Lewis is a Professor at the Department of Human Development and Applied Psychology, University of Toronto. He specializes in the study of personality development as it relates to emotion. His work is informed by developmental psychology, affective neuroscience, and a dynamical systems perspective on brain and behavior. He has done empirical work in the area of transitions in cognitive and emotional development, and he has developed a state space grid methodology to facilitate the analysis of socioemotional behavior over time. More recent work utilizes electrophysiological methods for identifying the neural underpinnings of emotion regulation in normal and antisocial children. His research outlining the contribution of nonlinear dynamics to our understanding of child and adolescent development has appeared in several highly regarded peer reviewed outlets, including *Child Development*, *Journal of Abnormal Child Psychology*, and *Developmental Science*.



Out of Time and In Over Our Heads: How Efficiency Swamps Individuals and De-Complexifies Organizations

L. Douglas Kiel

Research from the fields of both evolutionary psychology and cognitive psychology reveal that the cognitive capacities of humans seriously lag behind the pace of evolving societal complexity. The continuing demand for efficiency in the developed societies increasingly serves to exacerbate both individual and organization effectiveness. The mantra of constantly doing more with less provides little time for workers to find the slack required for organizational learning. The concept of the learning organization thus is replaced by the entropic organization in which the chaos of innovation is overwhelmed by the chaos of dissipation. In short, workers find themselves out of time and in over our heads. This condition clearly serves neither the purposes of individuals or organizations.

Dr. Kiel will explore what these trends mean for organizations. We may find that the organizational response to evolving societal complexity may require considerably more thought as to the real capacities of the human brain and human organizational forms. The history of management and organizational studies is founded on novel proposals, if not solutions, to the challenges of organizational success. We may need to start with a more basic appreciation of how humans are hardwired before we can create organizations that serve the dual purposes of individual satisfaction and organizational success. The potential chaos created by these new innovations will be one of the great challenges for leaders in the 21st century.

L. Douglas Kiel is professor of management in the Social Sciences Department at University of Texas, Dallas. He is well-known for his books, *Managing Chaos and Complexity in Government* (1994, Josey-Bass) and *Nonlinear Dynamics, Complexity and Public Policy* (co-edited, 1999, Nova Science) and related contributions to organizational theory and practice. He was also the guest co-editor of the NDPLS special issue on Agent-Based Modeling (April, 2004).

