Society for Chaos Theory in Psychology & Life Sciences

Dedicated to the development of nonlinear science worldwide since 1991

Abstracts to the 17th Annual International Conference, Orange, CA

2007

2007 CONFERENCE
SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY & LIFE SCIENCES

July 27-29, Chapman University, Orange, CA

PROGRAM ABSTRACTS*

Listed Alphabetically by First Author

1/f Scaling Relations in Speech

Anderson, Gregory & Kello, Christopher
George Mason University

1/f scaling relations have been observed in the fluctuations of a number of human behaviors, including gait, finger tapping, interval estimation and mental rotation, but its relevance to cognition is unknown. Proposed explanations to date have been strictly process-specific and fail to address any relation between cognition and the multitude of other systems found throughout the sciences exhibiting 1/f scaling relations. This research examines scaling relations in speech activity. Over multiple repetitions of a single word, numerous parallel acoustic measures were found to exhibit uncorrelated 1/f scaling relations. While there are conceivably unlimited cognitive processes to account for all the different behaviors that exhibit 1/f scaling, process-specific accounts lose all explanatory power when addressing parallel yet independent scaling relations. An alternate explanation is that 1/f scaling relations in speech, as well as other behaviors, represent coordination of constituent parts to maintain balance between independence and organization around a target behavior. When 1/f scaling is viewed as resulting from the coordination of components, parallels are drawn between cognition and other complex systems throughout the sciences through the concept of *metastability*. Metastable systems throughout the sciences exhibit 1/f scaling, and even simple models can account for the multiple parallel independent scaling relations found in these speech data.

The Evolution of Moral Science: Economic Rationality in the Complex Social System

Aruka, Yuji
Faculty of Commerce, Chuo University, Japan

Economics in the early 20th Century established distributive justice as the marginal productivity theory of income distribution. As the system has evolved, however, the distributive principle has been lost as a result of the structural change of the production process. Faced with casino capitalism or the winner-take-all society, instead of the classic distributive justice, a lottery system dominates income distribution. Orthodox economics prefers a set of particular rationalities, e.g., the so-called game theoretic views, instead of the general rationality. These particular rationalities are examined in some detail and their failures are argued. Rationality, either in general or in a particular form, is not to be regarded as a panacea in the complex socio-economic system. This paper proposes the use of the utilitarianism of heterogeneous interacting agents. This new utilitarianism may easily be applied to the transition rates of the master equations, i.e., the probabilistic Markov process. Furthermore, a new method to reconstruct economic science is also suggested: constructing methods derived directly from new ideas in statistical physics and combinatorial stochastic process. In sum, individualistic rationality must be replaced with the utilitarianism of heterogeneous interacting agents. In this new framework, solidarity formation among the heterogeneous interacting agents should be the most important matter. Finally, a deeper consideration on the utilitarianism of heterogeneous agents is explored.

Birds of a Feather Flock Together: Learning Communities in the Realm of Complexity

Braga, Junia de Carvalho Fidelis
Applied Linguistics-Language & Technology
Universidade Federal de Minas Gerais, Brazil

Martins, Antonio Carlos
Universidade Federal de Minas Gerais (UFMG)

The creation of learning communities has been recognized as a pedagogical intervention capable of embracing course designs that take into account negotiation and collaboration. Based on this understanding, this presentation aims to share the ideas of two empirical studies in process in the Graduate Program in Applied Linguistics at Universidade Federal de Minas Gerais, Brazil. Drawing on Chaos and Complexity Theories and on the literature of learning communities, The Complexity of Learning Environments, a longitudinal ethnographic work, discusses the content of the interactions that emerged in an academic writing course for English learners designed in a blended environment so as to give students the opportunity of interacting both on-line and face-to-face. Following in line, the second study, Online Learning Communities in the Realm of Complexity, discusses the main characteristics and functions of online learning communities as well as the development of learner critical reflection in this environment. The analysis of this work was based on ideas that emerged from the interaction of 50 students who participated in a 20-week course for pre-service teachers. These students were divided in small groups and interacted in online environments without the direct intervention of the teacher. Both studies demonstrate evidence of the presence of non-linearity, adaptability, self-organization, and emergence - common properties of adaptive complex systems - in the communities investigated. Moreover, their results point toward the evidence that mutual engagement is a crucial element in the process of shared knowledge construction, the core characteristic of learning communities in the arena of Education

A NLD Approach to Exploring the Spiritual Dimensions of Occupation

Champagne, Tina, Ryan Janice, Saccomando, Howard & Lazzarini Ivelisse
Creighton University, Nebraska

This poster presentation explores the spiritual dimensions of occupation using a nonlinear dynamic systems model to address the interrelationships between spirit-mind-body-world. A deeper appreciation of the wholeness of human occupation emerges within a spiritual paradigm reflecting the fundamental complexity, nonlinear processes, and pattern flow formation of dynamic human occupation. Emergent perceptions about life-meaning, purpose, and identity are understood through the model of intention, meaning, and perception, influencing the system-wide changes that occur during spiritual occupation. Viewing spiritual occupation as both the creative process (means) and as engagement in spiritual activities (ends), which sustain and support life and health, affords a nonlinear view of the spiritual dimensions of personal growth through the process of self-organization and self-transcendence. Nonlinear dynamic systems modeling of broad and deep spiritual occupations further validates the theory and practice of occupational therapy by addressing the full complexity of occupation as an embodied process of spirit-mind-body and world.

The PH Dependence of the Peroxidase Oxidase Reaction in a Cell Model of Neutrophils

Coumbassa, Ibrahim Sory
Laboratory of Physical Chemistry and Colloid Chemistry,University of Conakry, Conakry, Guinea
Kummer, Ursula
Bioinformatics and Computational Biochemistry

Dissipative structures such as chemical oscillations and traveling metabolic waves arise in biological systems due to reaction-diffusion processes and their non-linear coupling. During the respiratory burst in neutrophils the enzyme nicotinamide adenine dinucleotide (phosphate) [NADPH] complex assembles in the membrane and converts oxygen through electron transfer to superoxyde anion, which is a precursor to H2O2 and HOCl. This electron extrusion into the phagocytic vacuole is compensated by a proton release into the cytoplasm. As a result pH changes are seen in activated neutrophils. Despite the massive H+ production and the associated membrane depolarization cytosolic pH of these cells remains at the physiological levels mainly due to proton transport through voltage-gated proton channels. In a recent experimental study H.R. Petty et al. reported sustained traveling waves of NADPH auto fluorescence and protons in individual morphologically polarized living neutrophils. Using the tools of the V-Cell UCHC/NRCAM and the Madonna software, we have developed a cell model of the time-dependent changes in metabolites concentration and pH. The model is based on the peroxides oxidize reaction catalyzed by myéloperoxydase found in abundance in phagocytes, with melatonin as a cofactor and t he NADPH oxidize.

Exorcising Entropy

Dean, Malcolm, Writer

If Chaos, Complexity, and Thermodynamics are such great ideas, why are they not widely understood and accepted? Why are they not fundamental topics at all levels of public education? In other words, if you're so smart, how come

you ain't rich? Taking the example of thermodynamics in living and cognitive systems, we explore how its presentation in negative, specialist terminology has blocked its acceptance even among otherwise highly qualified scientists. Beginning with the troubled history of "entropy," we show that a mathematical dialog among specialists has blocked a general appreciation of thermodynamics. Ignoring the warnings of von Neumann and E.T. Jaynes, entropy and dissipation are presented as the core thermodynamic insight, leaving the creation and evolution of living systems as ignorable mysteries. A catalog of the many "entropies" which have been proposed shows that the work being accomplished is more to the convenience of specialists in sub-fields, than to making universal laws comprehensible to everyone. It is not enough to present Chaos, Complexity, and Thermodynamics as mathematical ideas. Their pragmatic values must be expressed in plain language accessible to all. This is the 6th working paper in Cognitive Thermodynamics. The 3rd paper was presented at SCTPLS Denver Conference in 2005.

Walking Straight and Walking Crooked: Myth, Metic Intelligence, and a Theory of Nonlinear Thinking

De Ciantis, Cheryl
Kairios Group, Santa Cruz, CA

Goertzel asserts that psychology is important for complexity science, stating that creativity, the wellspring of complexity science and all science, is seen to require all of complexity science, and more, for its elucidation. I assert that myth is a significant part of the more required to elucidate the psychological processes of nonlinearity in creative thinking. Plato introduced the metaphor of those who walk with an unimpaired, straight gait to represent the linearity of classical logic that still confers legitimacy upon ideas in Western culture. Yet, Hephaistos, the mythic, crippled Greek god of technology, walks with a crooked, irregular gait. Hephaistos possesses metis, an ancient Greek term which denotes the traits of resourcefulness, subtlety and deceptiveness, and the situational characteristics of transience, ambiguity, and resistance to precise measurement or exact description. A similar, and similarly ancient, Chinese term, zhi, is compared to the Greek and described by Raphals as metic intelligence. This paper will present an examination of the Mediterranean and Chinese mythic understandings of creative nonlinearity in light of concepts including autopoietic thought systems as described by Goertzel and Jungian psychological type theory to arrive at a preliminary theoretical description of nonlinear thinking. Further, the paper will examine how Greek and Chinese myths demonstrate that both linear and nonlinear thinking are required for creativity and innovation. This paper will develop ideas first presented at the Second International Nonlinear Science Conference in Crete in 2006.

Organizations as Complex Living Systems: Concepts and Tools for Analyzing and Understanding the Behavior of Organizations

Dietz Steven A., Criminal Justice, Texas State University-San Marcos
Owen, Keith, Somerset Consulting Group

Human organizations are created to accomplish a purpose, such as to make a product, or provide a service. While many organizations are created, the fact is, in the history of organizations, only a relatively few achieve great success and some form of sustainability in accomplishing this purpose. Many, if not most, just get by, and a large number fail. The usefulness of a set of tools is in direct proportion to how effectively they impact not just the short term but also the long term quality of decision making and action and, in our view, tools based on the assumption of control and predictability are inadequate. We believe an alternative to this traditional way of viewing organizations is to view them as complex adaptive systems which obey the principles of such systems. This presentation will discuss human organizations in terms of purpose, capacity to learn, boundaries, and attractors, and present a complexity model for analyzing human organization called Full Continuum Analysis.

Leadership in the Computational Organization

Dooley, Kevin, Arizona State University

For many years scientists have explored the connection between information and nature. This computational perspective posits that the state of a system is transformed from one moment to the next through simple, recursive rules. In such a system order and complexity emerges from local interactions amongst agents rather than being exogenously imposed. In this presentation I will explore the following research question: If we accept that all processes in an organization can be viewed as a sequence of computations, what does this imply about leadership? My model describes interactions between dynamic streams of resources, activities, outcomes, and organizational fitness. The model highlights two issues that are not commonly discussed: attention and timing within a complex system. The model also suggests that the process of leading in a complex system is better thought of as a process of influence rather than as an interaction or relation. Finally, the model provides a way to define the role of managerial leadership within a complex system without evoking arguments about positional authority or organizational structure.

Complex Dynamics of Vision

Eoyang, Glenda
Human Systems Dynamic Institute

Vision is a central theme in religious, organizational, and personal development literature and action. Why and how does vision function in the complex dynamics of human system development? From the perspective of linear causality, the vision is the end point toward which the human system (individual or group) is pulled. It can be seen as the pre-determined culmination of a Newtonian, predictable process. The nonlinear, complex adaptive systems perspective denies the possibility of predetermined ends, so what is the role of vision in the growth, learning, and adaptation of human systems? This paper explores the theoretical and practical role of vision in self-organizing human systems. The CDE Model for conditions of self-organizing frames the theoretical ground, while Malcolm Cohan's video vision statements frame the practice. Participants will reflect on the role of vision in their own developmental journeys and consider practical ways to influence individual and group action in human systems of all sizes.

Nonlinear, Directional Model for Change in Human Systems

Eoyang, Glenda, Human Systems Dynamic Institute

Models of change and learning abound in the traditional worldview of simple, linear causality. These models describe predictable sequences of beginnings, middles, and ends, and they prescribe effective decisions and actions to move a system forward through a change process. Complexity research, on the other hand, describes logical sequences in historical data, but has not been able to articulate a prospective model of directional change that is consistent with the unpredictable, massively entangled, and mutually causal, nonlinear dynamics of human systems. This paper presents a directional and nonlinear model for change that was derived from the dynamical evaluation of a complex, multi-site healthcare collaboration between academic and clinical institutions. The project is described, the model is presented, and illustrations from the project are provided for individual learning, team development, organizational change, and industry transformation.

Development of a Rationalizing Heterogeneous Agent-Based Model for Small Work Groups in different Software Development Environments

Gibbs, Phil; Haslett, Tim & Osbourne Charles ,
Monash University, Australia

The project explores personal trait effects on harmony within work-based team environments. Using a multi-agent platform with complex non-linear interactions, we model individual behaviors including environmental and group feedback over time, capturing the time evolution of individual character and behavior. Rationalizing and deceptive behaviors will be included. *Discussion Points:* The interactions between individuals are analyzed using speech episodes (an entire block of interaction) to include 3 modes of communication: the written word, symbology, and the spoken word. The underlying intent of the message will be addressed. In reality, intent cannot be accurately measured, however, its inclusion allows the testing of an hypothesis that the receiver's interpretation of intent of communications may be responsible for group members' sudden behavioral shifts. Some techniques for modeling individual character and behavioral tendencies, producing sufficient complexity to represent observable group behavior, are investigated. A Multi-Agent framework is developed to model complex behaviors with feedback; with quantification of individual and group dissonance. Based on software development team experience, two real-world scenarios are modeled: (1) a professional group managed in a manner resulting in many members being disenfranchised. The work output is of high quality, minimizing environment impact but emphasizing the group leader's controlling behavior, and (2) a cohesive group existing in an extremely adverse environment. The group's cohesiveness and a powerless, but protective manager transcends restrictions on the group's ability to influence the quality of production.

Public Sector Organizational Pattern Fitness Over Time

Glor, Eleanor,
The Innovation Journal

The fate of organizational fitness over time is of interest to students of organizations, but difficult to conceptualize and study, because of organizational complexity and hence unpredictability. This paper explores the nature of

organizational unpredictability, not at the level of the organization, but rather at the level of organizational patterns. It asks, even if organizations were unpredictable, are organizational patterns equally unpredictable? Are all organizational patterns equally unpredictable? Can, indeed, the fitness or lack of fitness of organizational patterns be predicted, even if the fate of individual organizations cannot be predicted? The paper develops a model for examining predictability of organizational patterns. First, work is reviewed in which eight organizational change patterns were identified, their fitness assessed, and they were assigned fitness scores. Second, using these fitness scores as evolutionary starting points, a simple model is developed for exploring the fitness of organizational patterns over time. The model starts in the present and considers possible deductive, sequential futures for two future time periods for each of the eight organizational fitness patterns. In light of the results, the nature of the fitness of organizational patterns over time and the differential effect of time on unfit and fit organizations are discussed. A hypothesis is developed, that the fate of unfit organizations is more predictable than the fate of fit organizations.

Ankle Movements During Supine Kicking in Relation to Gastrocnemius/Soleus Muscle Tendon Length in Infants Born Preterm and Fullterm

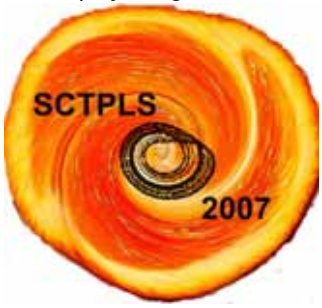
Grant-Beuttler, Marybeth
Physical Therapy, Chapman University

Systems theory suggests that body subsystems can influence movement outcome. Active ankle movement may be influenced by the ankle muscle tendon unit. The purpose of this study is to examine correlations between muscle extensibility measures and active ankle movements in infants. Ankle movements during supine kicking were correlated with measures of gastrocnemius/soleus muscle tendon unit length in 20 infants born full-term and 22 infants born pre-term at newborn, 6 weeks, and 12 weeks of age. Results: Simple and semi-part correlations suggest small to large correlations between muscle extensibility measures and active ankle kinematics. The strongest relationship was between the taut tendon, relaxed muscle belly and maximum plantar-flexion at 12 weeks of age (r = .48) with semi-part correlations explaining 26.8% of the variability while controlling for knee movement. Discussion: Correlations suggest ankle kinematics are related to measures of muscle extensibility and support continued examination of this relationship during later development.

Performance Dynamics in Stag Hunt Games as a Function of Group Size

Guastello, Stephen & Doyle, Meghan
Marquette University

Stag Hunt is a strictly cooperative game and requires players to choose between joining a group and working alone. Stag Hunt groups are inherent in emergency management team dynamics, and they lend themselves to the study of social loafing. A prior study (NDPLS, July, 2004) showed that the number of people who actively participated in groups' decisions was negatively affected by the adversary's progress on a previous iteration of the game. The present study investigated the effect of group size on the performance dynamics over time of groups of various sizes against an adversary. Groups of 4, 6, 9, and 12 undergraduates (23 groups total to date) played a board game (The Creature that Ate Sheboygan) against an adversary who worked alone. The teams' performance dynamics were chaotic, and the fractal dimension of the series was unaffected by group size (Dim = 1.52). Chaos was signified by a positive Lyapunov exponent and was interpreted as an indicator of adaptive capability Teams' performance on a given iteration was negatively affected by the adversary's performance except in the case of 12-person groups, where the teams increased their adaptive output (R2 = .86 - .90). The performance dynamics of the adversary were not affected by the progress made by the teams on the previous iteration (R2 = .67 to .75). Their chaosticity level was generally higher (Dim = 2.61 overall) than the teams, although it was less when the adversaries played against teams of 12 (Dim for 2 groups = 1.88, compared to Dim for 21 groups = 2.69). The results indicate that the groups are affected by signs of their own self-efficacy while individuals are not so affected. There also seems to be an adaptive threshold that is crossed when the team size increases to 12.



Entropy Conservation in the Dynamics of Human Action

Hong, Lee & Newell, Karl
Kinesiology Department, The Pennsylvania State University

The human motor system adjusts its movement patterns in order to adapt to constantly changing task and environmental contexts. In this paper we develop the position that the probabilistic nature of human action can be characterized by entropies at the level of the organism (Bernstein), task (Fitts Law), and environment (Hick's Law). We will show that systematic changes in movement dynamics can be characterized as tradeoffs in entropy between the organism, task, and environment. Such compensatory processes lead to a view that the control of goal-directed

action is the product of entropy conservation across the task-organism-environment system. We present a novel perspective on human movement dynamics where context dependent adaptations are guided fundamentally by natural law.

Comparing Three Methods for Modeling Religious Diversity and Change

Horlacher, Gary & Silverstein,
Merril , USC

Three methods have been proposed for extending linear, continuous change models to include discontinuities: polynomial regression (Guastello, 1995), multivariate regression (Lange, Oliva, & McDade, 2000), and stochastic modeling (Cobb, 1998; Hartelman, 1997). This paper focuses on two questions. How do results of these three methods of fitting data to catastrophe theory models compare with each other? Is it possible to set up nested models to compare models from the most general five-dimensional butterfly model to the most constrained traditional linear model? For comparing the three approaches, a hypothesized model of religious diversity and change (Horlacher, 2007) is tested. Data come from the longitudinal study of generations (LSOG) which has surveyed four generations of the same families since 1971. The hypothesis suggests that religious diversity and change will fit a model with butterfly dynamics, while a subset of young members of absolutist religions and non-affiliated individuals will fit a model with cusp dynamics. Model parameters are estimated using all three methods and results are compared. The second part of this paper explores the possibility of setting up a nested model test to determine the most appropriate model. Cobb (1998) has suggested that the cusp model can be expressed as a generalization of the linear change model. Since the cusp can be seen as a subset of the more general butterfly model, it should be possible to set up the models in such a way as to use nested models to test the most appropriate of five models from most general to most simple: butterfly, swallowtail, cusp, fold, and linear.

Elementary School Children Perception of School Lawfulness

Israelashvili, Moshe & Chen, Carmen
Tel Aviv University

The current study explored the amount to which elementary school children perceive their school as a lawful situation, i.e., an environment in which one can comprehend order and connections between behavior and events and themselves as followers of these laws. The sample consisted of 220 4th-6th graders, from various ethnic backgrounds and of the two genders. In addition to the students, classes' main teachers ("Educators") completed a questionnaire about each student's school adjustment. Data showed gender difference but no age or ethnicity difference. Pearson correlations indicated significant relationships between students' report on themselves as law-keepers and teachers evaluations of child's adjustment to learning demands, but not social life, in school. Further analysis of children reasoning of keeping laws demonstrated that those who are more aware of school lawfulness are those who are afraid of being punished at school. However, those who are law-keepers do that due to a mixture of various reasons. Altogether these findings indicate that elementary school children are able to follow the derivations of situational order, i.e., the lack of chaos, better than to clearly identify and/or literate it. Implications for research and practice will be discussed.

Service and Trade Group Performance: Linear and Nonlinear Model Fit and Optimization

Jacobsen, Joseph
Management, Innovation and Research: Individuals and Organizations

Service and trade group performance data were examined for linear and nonlinear model fit and optimization. Expert system software was used to collect proactive and reactive work order histories and performance records concerning 120 services for several years in a large municipal government where technician and trade group employees work in an operations division. Both linear and nonlinear models were supported by the data, regions of optimal performance were identified and system capacity is used to improve. Not so surprisingly, it became apparent that the rank and file wanted to improve but management stood in their way.

Does Idiosyncratic Risk in Multi-Factor Pricing Models Really Contain a Hidden Non-diversifiable Factor? A Diagnostic Testing Approach

Jeng, Jau-Lian,
Azusa Pacific University

This paper proposes a residual-based rescaled variance test for hidden factor(s) in idiosyncratic risk by investigating the partial sums of projection errors in multifactor pricing models. If there is a hidden diversifiable factor or there is no

hidden factor at all in the idiosyncratic risk, the test statistic will approximate a functional for the range of Brownian motion. The diagnostic test for short/long memory can be performed as a reality check for this residual risk. If on the other hand, under the alternative hypothesis that there is a non-diversifiable hidden factor, the test is also consistent.

Scaling and Entropic Properties of Mood Symptom Self-Report in Health and Illness

Kreindler, David, Dept. of Psychiatry,
Lumsden, Charles. Institute of Medical Science; Dept. of Physics
Levitt, Anthony, Dept. of Psychiatry
Woolridge, Nicholas*,* Division of Biomedical Communications, Department of Surgery,
All authors: University of Toronto, Canada

Subjective symptom self-report is a fundamental tool of clinical psychiatry. The usefulness of power spectra and entropy calculations on quantitative ratings of subjective symptoms for characterizing health or illness has been discussed but is not yet well established, despite the need for robust indicators of patterns and trends in these time series data. Method: Using visual analog scales presented on wireless handheld computers, we collected subjective intensity ratings of eleven symptoms characteristic of mood disorders from (n=19) healthy participants and (n=19) people with bipolar disorder every twelve hours for eighteen months. We used Lomb's method to estimate power spectra. To quantify measures of temporal disorder, sample entropy and approximate entropy values were calculated. Results: The Lomb periodograms were well fit by a power law over two orders of magnitude for all measures; the corresponding power law exponents were consistently non-positive, with no difference between healthy and ill individuals, suggesting that mood symptoms' temporal organization is self-similar and free of a dominating time scale. The entropy measures suggested, as recently proposed, the presence of temporal disorder in the mood data not well assessed with power spectrum techniques. Conclusion: Subject to the limitations of this study, frequency scaling appears to be a general property of mood symptom self-report, and is an important constraint for any hypothesized model of mood. The absence of a dominant frequency in self-reported mood calls into question diagnoses based in the time domain such as seasonal affective disorder or pre-menstrual dysphoric disorder.

Positive Maladjustment as a Transition from Chaos to Order

Laycraft, Krystyna
Center for Chaotic Studies, Nanton, Canada

The Positive Disintegration (Dabrowski, 1996) is the process of transition from the point attractor (primitive integration) to the cycle attractor (unilevel disintegration) and then to the chaotic attractor (spontaneous multilevel disintegration) and an emerging order (organized multilevel disintegration) and an order (secondary integration) with increasing complexity. A driving force for this development is the movement from simplicity toward complexity. Mental structure is maximizing its complexity and therefore its stability by pushing forward to higher levels. We analyze in details the spontaneous multilevel disintegration described by the chaotic attractor. The spontaneous multilevel disintegration corresponds to the period of adolescence. As an individual makes transitions from childhood to adulthood, from dependence to independence, the changes in behavior are dramatic. As soon as person feels that some modes of thinking, feeling, and acting are higher, conflicts of a vertical nature arise. Emotional, unconscious and slightly conscious forces dominate the spontaneous multilevel disintegration. We show that the process of spontaneous multilevel disintegration corresponds to dramatic changes in brain of adolescent. During adolescence, brain organization and function enter a unique period of change. The emotional behavior of adolescent is due to increased reliance on the instinctual part of brain (amygdala) while the area of rational thought, the frontal lobes develops. We postulate that the positive maladjustment appears when the brain activity of teenager seems to shift from amygdale to frontal lobes and emotions becomes more conscious and selective.

Exploring Human Perception

Lazzarini, Ivelisse
Creighton University

Traditional science has consistently disregarded individual differences with respect to perceptual states. Many of the studies on perception only report average perceptual states as opposed to the nonlinear dynamic variability of human perception. This study investigates the visual perceptual systems of individuals with respect to a specific object. In particular, probing what is perceived when looking at a given object? For many investigators the quandary of perception resides in how properties of the world come to be represented in the mind of the perceiver. In this project, however, I am less concerned with the content of perception and focus on the dynamics of perceiving.

Learning Dynamics: A Panel Discussion

Lazzarini, Ivelisse and Eoyang, Glenda
Creighton University and Human Systems Dynamic Institute

What we have to learn to do, we learn by doing- Aristotle.
Learning is the process of acquiring a skill, thus, a meaningful experiential process. Traditional views explaining human learning encompass a variety of definitions, approaches, theories and methods. However, at the level of coordinated human behavior and from a nonlinear perspective, learning arises as a self-organized adaptation of already existing behavioral patterns in the direction of the task to be learned (Kelso, 1995). A short theoretical discussion of learning views combined with practical applications will be used as premise for our discussion.

Epistemology in a Symmetric World

Malloy, Thomas, Butner, Jonathan, Cooper, Joel and Smith Drew
Department of Psychology, University of Utah

Epistemology addresses how we know what we know. A deep question for epistemology is how (without a homunculus) sentient beings discover new ideas that are within their structural capacity but beyond its previous experience. A second deep question is how sentient beings construct coherent forms from the raw flows of process? We will address both these questions with a proposal that is deeply connected to symmetry and symmetry breaking. As an example of one approach to epistemology, Gregory Bateson bases knowledge in the flow of differences in a richly connected network and, more importantly, in finding the differences in such patterns of difference. We argue that these patterns of differences are examples of broken symmetries sharing properties with other broken symmetries from the same symmetrical set.

The first paper will provide a brief review of Boolean math and of our previous work with Boolean simulations of knowledge including how to find derivatives in the discrete case (defined as TAO matrices) and how attractor cycle lengths that are powers of two produce profoundly different sequences of higher-order derivatives than cycle lengths that are not powers of two. It will then introduce a new analysis called Meta-TAO. Meta-TAO finds the differences between Boolean derivatives (TAO matrices) and acts like a Boolean parallel to a phase portrait. All these concepts will be summarized by a visual overview of how the basin landscape in Boolean systems can be related to symmetry theory.

The second paper will demonstrate that the taking of differences in the flow of differences is a folded (in the general case) self-affine Sierpinski gasket. This will explain why the higher-order derivative sequences for power of two and non-powers of two cycle-lengths act as they do because powers of two cycle-lengths synchronize with the Sierpinski gasket and the non-powers of two fold the gasket. Furthermore it will show that due to fractal redundancy only some TAOs and Meta-TAOs are required for an analysis of the system.

The third paper demonstrates the astonishing quality that certain Meta-TAOs contain information about system trajectories that exist in other basins in the landscape, consistent with a broken symmetry hypothesis. This means that taking certain kinds of (meta) differences in differences found in a current attractor cycle is a well-defined epistemological process that not only identifies other basins of attraction in the landscape but also how to get to them without the system having previously been in that basin. Other theoretic approaches to exploring landscapes have depended on random perturbations, genetic algorithms or similar strategies. The new Meta-TAO analysis uses information in the broken symmetries implicit in the whole landscape to recreate parts of the landscape from information in a single attractor cycle.

The final paper will integrate the prior papers by showing how phase relations among flows of difference generate dynamic forms and how TAO and Meta-TAO provide tools for analyzing such phase relations in a world of broken symmetries.

Self-Similarity: Nature's Stamp of Identity

Marks-Tarlow, Terry
Clinical Psychologist, Private Practice, California;
Research Associate, Institute for Fractal Research, Kassel, Germany

It is all too easy to get lost in our own subspecialties and ignore the big picture. This paper addresses universal dynamics suggested by power laws, fractals, small world networks and

other forms of self-similar self-organization. Self-similarity and self-affinity are newly recognized symmetries by which transformations in time and/or space leave the central pattern unchanged. This paper explores the notion that self-similarity is the basic mechanism by which nature cobbles identity

Power Laws as Telltales of Emergence-in-Action

McKelvey, Bill, UCLA Anderson School of
Management, UCLA

Gell-Mann (2002) defines effective complexity as regularities or schema found or judged to be useful. They appear as equations, genotypes, laws and traditions, and business best practices. What is new is Gell-Mann's recognition of a new chaos-derived regularity created by separating out the pink, brown, and black portion of Schroeder's (1991) colored noise from white noise. He identifies two regularities. 1. Reductionist Law-like Regularities: The reductionist causal processes of normal science, which are predictable and easily represented by equations the data and information much preferred in classical physics and neoclassical economics. These are the point attractors of chaos theory. 2. Multilevel Scale-free regularities: Outcomes over time that result from an accumulation of random tiny initiating events that have lasting effects, are compounded by positive feedback effects over time, and become frozen accidents. These are the strange attractors of chaos theory.

Three complexity implications are identifiable: 1. Recent research shows that power laws do indeed indicate adaptive as opposed to static systems language, firms, economies (Dahui et al., 2005, 2006; Ishikawa, 2005; Podobnik et al., 2006) thereby offering preliminary support. 2. If power laws are not evident in a particular system, we can only conclude that emergence, if it exists at all, is not multilevel. We can also conclude that, absent the power law signature, a system's emergence dynamics are not capable of keeping it competitive with its changing environment. 3. Researching, theorizing, teaching and preaching complexity theory is useless absent scale-free theory. Chaos and complexity theories merge at the point where they focus on fractals.

Innovation Logic, Networks, and Organizational Change: An Agent-based Model

Medina, Una E., Communication & Journalism
University of New Mexico
Rivera, Mario, School of Public Administration
University of New Mexico

Little is known about how individual innovation logic influences the formation and dissolution of collaborative networks during organizational innovation and change. This is remarkable because the two-way influence between individuals and their networks has been identified as critical in the diffusion of innovations. Significant gains have been made over the last two decades in the applied study and utilization of networks for change management in both the public- and private-sectors

Chaos as a Limiting Factor in Population Dynamics Modeling: A Few Examples

Medvinsky, Alexander, Gonik, Maria & Li, Bai-Lian
Institute for Theoretical & Experimental Biophysics, Pushchino, Russia, and University of California, Riverside, USA

We discuss the problems pertaining to the complex character of population dynamics. The case studies of the complex model dynamics of (a) an agricultural ecosystem under invasion of pests resistant to Bt toxins produced by genetically modified insecticidal crops, (b) plankton populations in a heterogeneous environment and (c) the Syamozero Lake fish community are given.

Innovative Research Methodologies in Studying Complex Interactions in the Context of Training in Infant-Family Mental Health

Natrajan-Tyagi, Rajeswari & Banerjee, Leena
Alliant International University, CA

Chaos theories deal with complex interactions between forces which interact in unpredictable and often fascinating ways. Nonlinear dynamics, chaos and complexity are very much a part of human interaction in families and in the therapeutic context. Research in this area needs to digress from more traditional methodologies that look for cause and effect and use methodologies that can tap into this complexity and be able to make sense of the underlying order in apparently random data. In this presentation, the authors will present one such methodology that was used in studying the development of therapeutic presence in clinicians working in the infant-mental health context and the results of this study. Process methodologies typically look at the complexities of events that occur within an

encounter (Hill, 1982). Process research first originated in the field of counseling around 1950 s (Heppner, Kivlighan & Wampold, 1999) and was more recently adopted by the field of marriage & family therapy during the 90s (Pinsof & Wynne, 2000). The authors chose this method of investigation to track the clinician's processes of self awareness development and technical learning and their connection to felt presence and felt competence in their infant-family mental health practice. The training of the infant-family mental health clinicians occurred in intense group encounters over a period of nine months. A significant moments approach to process research (Campbell et.al., 2003) was utilized to study the process that was involved in the clinicians' learning and development. This approach utilized several tools such as reflective journaling, phenomenological interviews and focus groups. During the presentation the authors will share the significance of such a methodology in tracking and investigating complex interactions. The results of the study will also be shared that explains how this attentive, intensive and in-depth approach to training and research in infant mental health affect clinical competence and outcomes for group members. The authors will also share how these methods deepen clinician's engagement, awareness, felt competence and presence in their work with infants and families.

Self-Organization and Psychotherapy

Pincus, David
Chapman University, Orange, CA

A common thread that runs through the numerous family, group, and individual approaches to therapy is the circular notion that rigidity and conflict may spread from individual to relationships and back, spreading across time and biopsychosocial space. However, the inherent nonlinearity of these types of processes has left them difficult to study through traditional methods. The result has been a proliferation of more than 400 overlapping clinical approaches with little or no explicit basis in scientific theory. Using self-organization as a theoretical framework, the current presentation reviews the relevant clinical and empirical literatures with the aim of integrating these various lines of inquiry into a more coherent framework for both clinicians and researchers. It is proposed that biopsychosocial processes impacted by therapy involve open flows of information across scales, from smaller biological processes up to larger scale social processes. Systemic phenomena of focus across therapy traditions including conflict, control, closeness, coherence and complexity may each reflect both structural and evolutionary significance as they emerge and spread across biopsychosocial scales. It is argued that self-organization may provide a common theory of psychotherapy process, capable of supporting a diversity of clinical approaches, without the need to label each new approach as a new theory.

The Fractal Nature of Developmental Stage Change: A Model and Transition Data

Ross, Sara Nora
ARINA, Inc
Commons, Michael Lamport
Harvard Medical School

The Model of Hierarchical Complexity (MHC) is a discrete state model that posits a series of ordinal-scale orders of increasing task complexity. The Model provides a mathematical expression of each order of complexity. Uses of the Model to date include the behaviors of individual animals and humans, organizations, and other social institutions. They indicate its applicability to tasks at various fractal scales, including those of time and social complexity. Dialectical processes of transition from any order to the next higher order are comprised of a sequence of discrete-state transition steps; these are scored on the ordinal scale, as are each of the orders. The sequence of tasks in transition is identical from order to order. The transition steps pattern is also fractal. The transition steps result in increasingly less partial organization of combinations of elements at the next order and at the same time, those elements increase in complexity from one order to another, with fractal similarities to the overall model. This paper uses the MHC s mathematical expressions of the orders as the foundation for this first description of the fractal nature of the transition steps. It includes scored examples of transitions at several different scales of time, social complexity, and hierarchical complexity. These will show scales, steps, and transition data. It invites collaboration to develop the mathematical models of these fractal transition processes. It indicates an extension of developmental science models, and suggests applications to decision theory, time series analyses, agent modeling, and other analyses.

Modeling Group Behavior with Genetic Algorithms

Roetzheim, William

Genetic programming relies for its success on the concepts inherent in complexity theory. The fundamental concept is to create a richly interacting system of components that exhibit random behavior. Using some external evaluation

criteria of fitness, those elements that exhibit emergent behavior that is somehow evaluated as good are rewarded by staying alive and being allowed to mate and reproduce. Those elements whose emergent behavior is evaluated as bad are killed off. It's a cold, hard world in the land of genetic programming. Genetic programming has been used to successfully model a wide range of complex group behavior that was difficult or impossible to model using traditional algorithms. This paper will present an overview of the concepts of genetic programming and describe how this approach to writing computer programs may be applied to the modeling of group behavior.

Sociatry

Sabelli, Hector
Chicago Center for Creative Development

Sociatry is a psychotherapeutic approach to human survival and emancipation, based on the fact that human processes are created rather than determined or random. Both notions originate, albeit not exclusively, from Jacob Moreno. His psychotherapeutic concepts of (1) action, (2) opposite complementary roles, and (3) creativity through spontaneity and conservation, can now be validated by the natural sciences. This article sketches how these notions can be applied today as a way to promote social and personal health, and introduces the color prototype, a cultural conserve for creative thinking and action based on quantum physics. This interdisciplinary basis stems from the notion that levels of organization, from physics to psychology, display homologous features, i.e. are fractal. The Morenean tradition, humanistic and clinical, is particularly appropriate as detached from political associations.

Economic Bios

Sabelli, Hector & Kovacevic, Lazar
Chicago Center for Creative Development

The time series of economic processes display creative features compatible with random walks, but that do not exclude causality. Bios is the class of processes that generate complexity causally. Daily and monthly time series from several categories were studied. These include Banking, Business/Fiscal, Consumer Price Indexes (CPI), Employment & Population, Exchange Rates, Gross Domestic Product (GDP) and Components, Interest Rates, Monetary Aggregates, Producer Price Indexes (PPI), Reserves and Monetary Base, U.S. Trade & International Transactions, U.S. Financial Data, Regional Data.. In all these series, dynamic analyses show (1) episodic patterning and asymmetric statistical distribution, typical of bios; (2) increase in variance with embedding (diversification), less recurrence than shuffled copies of the data (novelty), demonstrating creativity; and (3) consecutive recurrence, partial autocorrelation, and patterning in the series of differences, indicating non-random causation. These results are discussed in the light of the demonstration that biotic patterns are generated mathematically by bipolar feedback processes, and have been empirically demonstrated in multiple processes, ranging in complexity from physics to music, and in size from quantum waves to galaxies.

Early Childhood Development: Roles for Natural Instances of Chaos in the Evolution and Development of Common Sense in Humans

Smith, Roulette
Director, Institute for Postgraduate Interdisciplinary Studies

Although mathematical and heuristic models of chaos are well-known in life, behavioral and social sciences, synergistic roles of chaos remain to be fully explicated. This report considers roles for chaos in the evolution and development of common sense in humans. Our term 'common sense' has a biological basis, with preliminary evidence suggesting that largely non-proteomic DNA in brain may be its repository. Accordingly, common sense is defined as core nurturance; formative mental speciation in herds; and/or, common and/or core psychosocial, moral and cultural beliefs in herds. Three types of naturally occurring chaos are considered. One type of chaos is associated with molecular and organic issues associated with in utero and early childhood development. A second type of chaos is associated with behavioral and social responsiveness, with particular attention delineating sharp distinctions among bonding and nurturance, affection, proper and poor parenting, childhood psychosocial and moral development, and community/society. A third type of chaos is associated with evolution and transmissible phenomena. In all instances, our focus is on the transmissibility of molecular and other information. In addition to the three types of chaos implicated in common sense, we distinguish between chaos at the front-end of developmental processes (contributing to nurturance and experience) and chaos at the back-end of developmental processes (contributing to outliers, aberrations, divorce, and, psychosomatic or other diseases). Finally, we re-introduce a notion of 'logistic information processing' (first promulgated in the late-1960s and early-1970s) in order to elucidate notions of 'kidultery'; wit, humor and cynicism; and psychoviruses (including transmissible negativism and passive-aggression).

A Cusp Catastrophe Model for Working-Memory Overload Hypothesis in Science Education Problem Solving.

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

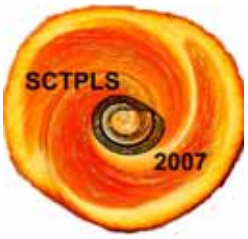
The present work is a part of an educational research, which explores the applicability of Catastrophe Theory for testing nonlinear hypotheses in this field. Research has shown that students' achievement in science education and particularly in problem solving is associated with some psychometric /cognitive variables, such as information processing capacity (working memory capacity and/or mental capacity). The information processing however interferes with other variables, such as field dependence-independence and/or logical thinking, which could act as inhibitory processes when the mental task requires it. That could lead to working memory overload and to student s failure. The present work adds to the previous research by examining the working memory overload hypothesis as a catastrophe effect and proposes a cusp model, which accounts for discontinuities in students' performance. Data were taken from tenth-grade student examinations in physics. Measurements were taken at two points in time, and the data analysis involved dynamic difference equations and statistical regression techniques. The model implements two cognitive variables as controls: Baddeley's working-memory capacity as asymmetry factor and logical thinking as bifurcation. The model demonstrates nonlinear interactions between students' mental resources and mental tasks. Problem solving is a dynamical process where nonlinearity is expected. This could explain students' failure and on the other hand suggests that teaching/learning problem solving should take into account the dynamic nature of brain functioning. Moreover, the results further support the nonlinear hypothesis and theory building in education. Implications for science education theories are discussed.

Bifurcation Analysis of Equilibria in Competitive Logistic Networks with Adaptation

Tebaldi, Claudio
Department of Mathematics, Politecnico di Torino, Italy

A general N-node network is considered for which, in absence of interactions, each node is governed by a logistic equation. Interactions among the nodes take place in the form of competition, which also includes adaptive abilities through a (short term) memory effect. As a consequence the dynamics of the network is governed by a system of NxN nonlinear ordinary differential equations. As a first step, equilibria and their stability are investigated analytically for the general network in dependence of the relevant parameters, namely the strength of competition, the adaptation rate and the network size. The existence of classes of invariant subspaces, related to symmetries, allows the introduction of reduced models, where N appears as a parameter, which give full account of existence and stability for the equilibria in the network, Reduced models are found effective also in describing time-dependent regimes, both in the form of periodic oscillations and chaotic behavior and with remarkable properties of synchronization.

Sequences of Cycles and Transitions to Chaos in a Modified Goodwin's Growth Cycle Model.



Claudio Tebaldi
Department of Mathematics, Politecnico di Torino, Italy
Giorgio Colacchio
Faculty of Law, Unversity of Lecce

The model introduced by Goodwin [1967] in A Growth Cycle represents a milestone in the nonlinear modeling of economic dynamics. On the basis of few simple assumptions, the Goodwin Model (GM) is formulated exactly as the well-known Lotka-Volterra system, in terms of the two variables wage share and employment rate. A number of extensions have been proposed with the aim to make the model more robust, in particular to obtain structural stability, lacking in GM original formulation. We propose a new extension that: a) removes the limiting hypothesis of Harrod-neutral technical progress: b) on the line of Lotka-Volterra models with adaptation, introduces the concept of memory, which plays a relevant role in the dynamics of economic systems. As a consequence an additional equation appears, the validity of the model is substantially extended and a rich phenomenology is obtained, in particular transition to chaotic behavior via period-doubling bifurcations.

Emotional Intelligence, Stress and Catastrophic Leadership Failure

Thompson, Henry L. (Dick)
CEO, High Performing Systems, Inc.

This presentation uses catastrophe theory to visualize, explore and predict the dynamic relationship among emotional intelligence, stress and leader performance. In a series of simulations, data were collected on these three variables. In one case, leaders responded to the BarOn Emotional Quotient-Inventory, a self-report instrument that measures emotional intelligence, in either a normal mindset or a stressed mindset. The results indicated that with a simple set of instructions asking respondents to assume a stressed mindset, significant downward changes in the total emotional intelligence and all 15 subscale scores were observed. The significant main effect for mindset has numerous implications, the most obvious being that individuals should not complete the instrument while in a stressed mindset. A second finding of this research is that the relationship between emotional intelligence and stress seems to be such that stress actually reduces an individual's ability to use his/her full emotional intelligence ability. The combination of high stress and low emotional intelligence may cause unexpected catastrophic leadership failures. The results, implications and applications are discussed using a cusp model response surface. This work opens up new approaches for emotional intelligence development, stress management and leader development.

Chaos Theory and the Self System

Weinberg, Rita
Educ. Psychology, National-Louis University,
Skokie, Illinois

Although the concept of 'a self' is a hypothetical construct, it has proved to be a useful psycho-social construct. Usually perceived as a central or core part of an individual's identity, there are many variations of what the idea of self system is like. The self is almost always considered an organized system. As part of the human dynamical organization, it is then considered non-linear. In this paper we will describe self system theories and different trajectories of their operational formats. We also discuss treatment models for inadequate, incomplete and damaged selves in contemporary psychological theory and practice. Different initial points of origin lead to different trajectories and outcomes. Fractals may play a significant role in self-concept and self esteem. Developmentally, the self evolves into increasingly complex self-organizations and appears to mature in late adolescence or the early adult years. Self systems continue to evolve or change as a result of certain experiences. We will describe the effect of such experiences and how they can break down the self system to evolve into new self-organization systems.

Optimal Arterial Pressure Analysis in Different Geographical Environment and Language Groups in the Terms of Complex Systems Theory

Zhirkov, Anatoly
Cardiology and Psychology Department, Dzhanelidze State Research Institute for Emergency Medical Care, Russia
Golikov, Alexey
Association "Harmony and Life"
Subbota, Alexander
Military Medical Academy
Kostenko, Victor
Dzhanelidze State Research Institute for
Emergency Medical Care

We have already demonstrated the potential of complex systems theory to facilitate in development of the human optimal arterial blood pressure (BP) formulas (Crete, 2006, Baltimore, 2006). Zhirkov-Golikov-Subbota (ZhGS) formulas are based on conception of resonance in isomorphic communication systems. The formulas consider the results of multivariate analysis and are represented as follows:

SBP = 100 + (Phi - 1) * A;
DBP = 100 * (Phi - 1) + (2 - Phi) * A;
MAP = (Phi - 1) * DBP + (2 - Phi) * SBP;
PP = (Phi - 1) * DBP; with Phi being the Phidias number (1.618...), A - age.

The purpose of our work is to consider whether it is possible to apply the mathematical harmony and chaos theory for BP assessment in different geographical environment and language groups. The work contains the results of the analysis of BP parameters, using ZhGS formulas of the scientific sources from the USA (JNC7), Great Britain (BmedSt), Russia (our own data) and India (Medindia.net). As a reference parameter we used a so-called golden

ratio, representing a special case of the solution of Mandelbrot equation. The obtained results demonstrate the high correlation of ZhGS formulas with the values, obtained in population studies. The closest correlations are revealed between the values, characteristic of Russian, Indian and Britain data groups. The authors conclude that it is possible to use these data for assessment of psychophysiological effect of stress factors in different geographical environment and language groups.

Abstracts from Invited Guest Speakers

Why Power Law Phenomena Serve to Integrate Chaos and Complexity Dynamics

Bill McKelvey

Chaos theorists define fractals in terms of attractor basins; complexity theorists define them in terms of rank/frequencies. Barabási's scale-free theory of preferential attraction combines both, with nodes as the attractors appearing in a rank/frequency power law. Andriani and McKelvey show seventeen different scale-free theories explaining many, but not necessarily all of the 80 kinds of power laws in the literature. Power laws are like weeds popping up all over the place. Chaos and complexity theories join in their focus on fractals, but with two basins of attraction thereafter: chaos theory uses catastrophe to further explore the increasing frequency of attractors; complexity theory and econophysics now attend to power law phenomena and scale-free theories.

Gell-Mann distinguishes between (1) the traditional regularities of normal science studied by reductionism using equations to formalize law-like algorithmic reductions; and (2) scale-free regularities appearing across multiple levels of "living" systems, which stem from chaotic, tiny initiating events to become frozen accidents. Here, elements of chaos theory and complex adaptive systems (CAS) are combined to highlight a fundamentally different kind of regularity requiring different kinds of scientific methods. Chaos and complexity theories are again joined. Since all living systems are under adaptive pressure, it follows that the second regularity is ubiquitous.

Since 1950 species-abundance biologists such as Preston, MacArthur and Holling along with SFI's Per Bak, a physicist, have suggested lognormal/power law phenomena represent a natural law of efficacious adaptation, ranging from moths to earthquakes and wars. Murray Gell-Mann's second regularity gives more credence to this idea: (1) a multi-level system must have scalable cas dynamics at multiple levels for adaptive success; and (2) efficaciously adaptive CAS dynamics, and indications of them, should exhibit power law signatures explainable via scale-free theories. There are a growing number of clues suggesting this idea to be correct. We already know this to be true with at least one core feature of human life—the best indicator of impending heart attack and death is a non-fractal heartbeat!

Additional and better tests of this idea should be at the top of chaos and complexity researchers' agendas. If the basis for believing that power laws are indicators of efficacious adaptation strengthens—is proved broadly true—it follows that scale-free, nonlinear dynamics are indeed the core feature of all living systems.

Bill McKelvey received his Ph.D. from MIT, 1967. He is a Professor of Strategic Organizing and Complexity Science at UCLA's Anderson School. McKelvey's book *Organizational Systematics* remains a definitive treatment of organizational taxonomy and evolution. He chaired the building committee that produced the $110,000,000 Anderson Complex. He directed over 170 field study teams on strategic improvements to client firms. In 1997 he initiated activities leading to the founding of UCLA's Center for Complex Human Systems & Computational Social Science. McKelvey has co-edited Variations in Organization Science (1999) and special issues of E:CO and JIT. He has 40 publications on complexity science applied to organizations.

The Average Person is Truly Exceptional: Where Medicine Went Wrong

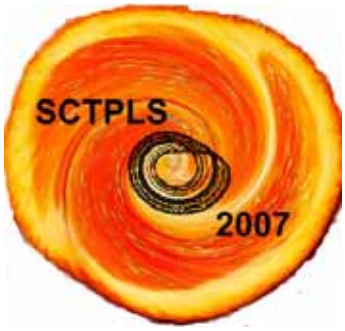
Bruce J. West

In the nineteenth century scientists began a systematic study of society using tools from the physical sciences. One such tool was statistics and the bell-shaped curve of Gauss. Today students are often graded with the expectation that a certain fraction will have A or F, a larger fraction will have B or D and most students will obtain a grade of C. This expectation is based on the statistics of Gauss, the average value and the notion that life ought to be fair.

We will explore the fallacy behind the reasoning for applying the bell-shaped curve to such complex phenomena as learning/teaching. In fact, I will argue that it is only in the physical sciences that phenomena are sufficiently simple that the statistics of Gauss apply; in the social and life sciences it is the inverse power law of Pareto that describes phenomena. From the distribution of wealth to the beating of the human heart we find that life has a fundamental imbalance, both in the distribution of wealth and in the measures of health.

The presentation will provide data from the life and social sciences so the audience will be able to follow the arguments without the burden of mathematics.

Bruce J. West received his Ph.D. in Statistical Nonlinear Physics from the University of Rochester in 1970. At present, he is the Chief Scientist of the Mathematical and Information Science Directorate at the US Army Research Office. Previously, he was a research scientist at La Jolla Institute, and for ten years a professor of physics in the University of North Texas. Over the years, his research interest has consistently focus in the application of nonlinear dynamics to biomedical and social phenomena. He has published eight books in these areas over the past twenty years at various levels of mathematical sophistication, founding such research areas as fractal physiology. He has published over 250 research articles; is a Fellow of the Army Research Laboratory; and a Fellow of the American Physical Society. Dr. West most recent work entitled: Where Medicine Went Wrong is the inspiration for his SCTPLS 2007 presentation.



SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY & LIFE SCIENCES