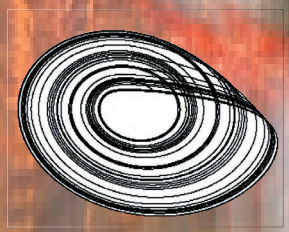
Society for Chaos Theory in Psychology & Life Sciences

Dedicated to the development of nonlinear science worldwide since 1991

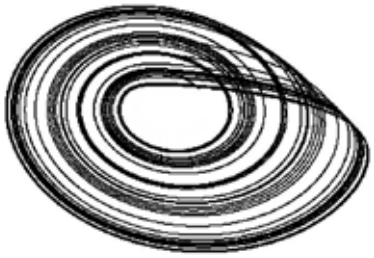
Abstracts to the 20th Annual International Conference, San Marcos, TX

2010



WELCOME to our 20th Annual Conference!

Welcome to the 20th Annual International Conference of the Society for Chaos Theory in Psychology and Life Sciences, at the wonderful facilities of Texas State University, San Marcos. This issue of the Newsletter is dedicated to the abstracts of all conference activity. This event attests to the ongoing scholarly commitment to the study of nonlinear dynamical systems processes and its applicability of a systems framework across a wide range of disciplines. We are pleased to offer you some of the best and most cutting edge work emanating from dynamical scholarship. Furthermore, as in previous years, scholars from many countries are represented here, creating rich opportunities for a productive cross-fertilization of ideas and insights.



Your 2010 Conference Committee

Society for Chaos Theory in Psychology & Life Sciences*
http://www.societyforchaostheory.org

SUNSET SESSION KEYNOTE SPEAKER

Kevin J. Dooley - The Weed Organization: A Survival Guide for Businesses the Day after Tomorrow

As if managing a business wasn¹t complex enough already, the business environment in the future is likely to be more volatile because of resource shortages and changes to our physical and social environments. This talk examines the current state and the future of business and sustainability through the lens of complexity science. First, I shall describe how Wal-Mart in concert with other retailers and manufacturers is using a complexity-like approach to create a sustainable product index for all consumer goods. Second, I shall predict what may happen to businesses at the "transition" between Consumerism 1.0 and 2.0, using far-from-equilibrium concepts. Third, I shall introduce the concept of the Weed Organization, a super-adaptive form of organizing that may come to dominate the future business landscape.

BANQUET SESSION KEYNOTE SPEAKER

Robert Goldstone - The Group Consequences of Individual Strategies for Imitation and Innovation.

Just as ants interact to form elaborate colonies and neurons interact to create structured thought, groups of people interact to create emergent organizations that the individuals may not understand or even perceive. To study the emergence of group behavior patterns, we have developed an internet-based experimental platform (for examples, see http://groups.psych.indiana.edu/) that allows groups of 2-200 people to interact with each other in real time on networked computers. Using these technologies, I will describe experiments on how innovations are propagated within a group. One series of experiments explores how people attempt to solve simple problems while taking advantage of the developing solutions of other people in their social network. The results suggest that complete information is not always beneficial for a group, and that problem spaces requiring substantial exploration benefit from networks with mostly locally connected individuals.

In a second line of experiments, we study the dissemination of innovations in a networked group for a multi-dimensional search problem with many local minima. We find evidence for several strategies that determine imitation and innovation decisions based on: similarity, choice popularity, timing, and success.

In a third, real-world application area, I consider historical data on how U.S. parents name their children. We find that naming choices are influenced by both the frequency of a name in the general population, and by its "momentum" in the recent past in the sense that names which are growing in popularity are preferentially chosen. This momentum bias has itself been increasing over the course of 130 years. For each of these areas, I will describe agent-based modeling efforts at explaining empirically observed patterns of exploration and exploitation, bandwagon effects, population waves, and compromises between individuals using their own information and information obtained from their peers.

SPECIAL MORNING SPEAKER

Philip Salem – Finding the Sweet Spot in Human Communication

The dynamic tension in all living systems is between similarity and difference. There are many sets of polarized terms representing this tension, but chaos and complexity scholars recognized this tension as amounts of information. Information represents the amount of relative variety – a mix of similarity and difference, and when the amounts were high, but not too high, the system moved to transformation – to the edge of chaos, to the complexity regime, to strange attractors, or to chaos, depending on the model. The sweet spot is that range of relative variety, just the proper mix of similarity and difference, leading to transformation.

Human communication is an emergent social process. It occurs when individuals in a social relationship create messages cueing each other as part of an ongoing episode. Human communication is an effort to make sense of an episode created by the process itself. The process constitutes our social and psychological life together.

This paper explores the dynamic tension in communication constituting three phenomena: (a) self, (b) trust in immediate and extended relationships such as social networks, and (c) organizations. In each case I will describe current literature highlighting tensions between similarity and difference, and I will explore the potential to move from one basin of attraction to another. The primary constraints on modeling communication transformations are discovering the appropriate parameters and bracketing sequences to define initial conditions, constraints common to modeling all nonlinear processes.

Abstracts of Pre-conference Workshops!

Stephen J. Guastello - Catastrophe Theory and Its Applications

Catastrophe theory describes and predicts discontinuous changes of events. It is perhaps one of the earliest modes of nonlinear dynamics to cross into the social sciences with empirical supporting evidence. Catastrophe models range from simple to complex, and involve different configurations of attractors, repellors, saddles, bifurcations, and control variables. This workshop will cover basic principles, some classic applications, and the statistical procedures that anyone can use to test catastrophe models. Emphasis is placed on techniques that can be performed with popular and available software. Recommendations for experimental designs are also included.

Dave Pincus – Nonlinear Dynamical Systems and Clinical Psychology

This workshop is designed for anyone interested in the application of nonlinear dynamical systems (NDS) theory to research applied topics in clinical psychology, from expert level clinicians and researchers to interested lay individuals who are new to NDS. The workshop will be divided roughly into research and experiential sections; with significant overlap between the two. The research-oriented section of the program will begin with a review of the current state of affairs within and among the various approaches to understanding personality and psychotherapy, relying upon four very broad categories: (1) Psychodynamic; (2) Cognitive-behavioral; (3) Experiential; and (4) Family systems. Using self-organization and related NDS concepts, these approaches will be integrated within the more parsimonious model of biopsychosocial dynamics. The most up-to-date empirical evidence will be reviewed relating to topics such as: Discontinuous phase transitions underlying clinical improvements in psychotherapy, the fractal properties of interpersonal process and personality structure, and the use of NDS methods for investigating resilience and wellness. The experiential section of the program will focus upon the use of these NDS concepts to obtain deeper and more integrated understanding of the array of modern techniques in psychotherapy (e.g., process-comments, empathic understanding, mindfulness practices, paradox, desensitization, and cognitive interventions). The program will conclude with a special emphasis upon the use of less widely known deep, transformation imagery techniques including live clinical demonstrations of these techniques.

Sara Nora Ross – How Order is Constructed in the Process of Emergence & Decision Making: Fractals Through and Through

In this workshop, Ross reviews basics covered in her 2009 workshop, and builds on them to show—and invite participants to *experience how* and *to measure*—the kind of fractal dynamics that are building blocks of what emerges in "emergence" and in particular, in individual and group decision making. The workshop emphasis is on a detailed look at not only (a) the nonlinear transition dynamics that generate increased complexity, but also (b) how they nest fractally as we process information. These increases in complexity are directly related to adult and other kinds of development, as accounted for by the general, math-based theory known as the model of hierarchical complexity.

Every decision is the result of having performed one or more of these multiple transition steps. When decisions are more complex, there are nested fractals of information processing required. Some decisions are more "complete" than others, and to analyze this is a core skill for evaluating the adequacy of individual and collective decisions. The workshop is relevant to anyone who wants to measure/analyze behaviors, whether in consulting or research. It is a must for those interested in such areas as "decision making under uncertainty." Workshop methods include presentation, individual and group exercises, reflection, and discussion.

Abstracts, Alphabetical by Authors

Chaos and self-perception

Gaetano Liborio Aiello, University of Palermo, DIFTER
Giorgio Vassallo, University of Palermo, D. Ing. Informatica
Enrico Bignetti, University of Parma, Lab Food Neurochem.

Information is associated with ' changes'. Any physical ' difference that makes a difference' is information. Information promotes interest, rouses expectations, keeps us watchful, induces specific behavior, and so on, which bears witness of the link between physical and mental. The mental should be associated (' mirrored') to some functional organization of the brain. Our ' system' is a network of N neuron-like, integrate-and-fire elements, each connected to C others arbitrarily. The network behaves as a complex nonlinear dynamical system. Provided the ratio C/N is less than %, the long term behavior closely resembles chaos, which suggests that chaos should be included among the dynamics properties of large, sparsely connected networks. Incidentally, the average connectivity in the human brain cortex ' where the mental allegedly arises ' is quite low, which portraits chaos as a ' natural' function of the healthy brain. But, then, what ' mental state/s', if any, would be ' mirrored' by chaos? Cells firing chaotically might be seen as blocks of a ' mutually vigil functional structure', in which every element is made aware through ever-changing, unpredictable interactions with the others. In absence of learning and adaptation the system oscillates chaotically, as in search of a stable state that is never attained. Nevertheless, deterministic chaos is other than the trivial ' humming' of a radio out of tune. It has a "structure". This allows the system to undergo transitions to potentially possible stable states via bifurcations. In this sense, deterministic chaos is viewed as a good metaphor of the state of 'self-perception'.

Quantifying the Process of Nicotine Intake by Addicted Smokers in Natural Settings Using the Fold Catastrophe and Videotaped Data

Xinguang Chen, Wayne State University
Elias Boueiri, Wayne State University
Fang Li, Wayne State University
Xun Zhang, Wayne State University

Absorbed nicotine exerts it effect by binding with specific nicotinic receptors in the brain and the biochemical kinetics of this ligand-receptor interaction can be expressed mathematically as Fold catastrophe. Studies have shown that dependent smokers titrate nicotine intake by changing their smoking behavior to optimize the effect, suggesting that the speed of smoking may also follow the Fold catastrophe. However, no study ever qualified the relationship. Materials and Methods: Participants of the study were smokers - years old, being diagnosed as nicotine-dependent using DSM-IV criteria and as non-dependent. The smoking behavior of the first whole cigarette in the morning of a day was videotaped for each participant. Levels of carbon monoxide in the exhaled air were used to determine if a participant smoked before and after videotaping. Time interval (in / second) of every smoking puff was derived from the video-taped data. Reciprocal of individual puff intervals was used as the measure of smoking speed (# of puffs/minute). Variations in the smoking speed were plotted against time and then fitted with Fold catastrophe model, based on the assumption that dependent smokers achieve optimal effect from tobacco by adjusting the speed of smoking (or nicotine intake) to match with the kinetics of the ligand (e.g., nicotine)- receptor reaction in the brain. Results: The plotting of smoking speed (# of puffs/minute) over time showed a 'U' -shaped pattern for the addicted smokers; and no clear U-shaped pattern for the non-addicted smokers. The depth of U-shaped patterns appeared to be associated with higher levels of nicotine dependence (as measured by number of the DSM-IV addictive symptoms). The Fold catastrophe fitted the speed data well for individual dependent smokers with r-square varying from .45 to .99. The initial speed of smoking Y at time-0 varied from 4.3 to 7.5 puffs per minute for addicted smokers; time from the start of smoking to the vertex point tb (equivalent to the time when ligang-receptor reactions reached the equilibrium) varied between 1.49 to 2.98 minutes. In addition, the r-square values, the average speed and the acceleration of smoking were positively associated with the number of dependent symptoms. Discussion and Conclusions: To the best of our knowledge, this study is the first of its kind to link smoking behavior with nicotine dependence using videotaped data and the catastrophic modeling method. Findings of this study imply a potential to develop objective measures to assess nicotine dependence, supporting more advanced tobacco research, diagnosis and treatment of nicotine dependence. Findings of this study also suggest that biochemically-based processes at the molecular level in the human body may be assessable through externally observable behaviors.

Complex Systems and Urban Sustainability

Oscar H Criner, Professor of Computer Science, Texas Southern University
Ralph W Ross, Graduate Student, Texas Southern University
Renard L Thomas, Assist. Professor of Health Science, Texas Southern University
Bobby Wilson, Professor of Chemistry, Texas Southern University
Katoria R Tatum-Gibbs, EPA Post Doc, U of North Carolina,
Robert L Ford, Professor of Chemistry, Texas Southern University

Symposium on Complex Systems and Urban Sustainability The urban complexity in food, water, and energy production and consumption By Oscar H. Criner and Ralph W. Ross The recent failure of the BP Deepwater Horizon is a tremendous shock to the ecosystems of the Gulf of Mexico. The dead zone is already greater than the size of New Jersey. This Mississippi carries a large amount of fertilizers, pesticides, nutrients, and chemicals into the wetlands of the Mississippi Delta. These wetlands are the most productive in the nation harvesting percent of the nation's shrimp in the twenty years before. Now, add the BP

failure and the result is a catastrophe. Ethanol fuel production and meat production industry compete for corn, which is used as a feed for cattle, hogs, broilers and other animals. These industries are also major water polluters. We show aspects of the unsustainable behavior of the complex system that produces food, water, and energy. Until sustainable processes are implemented that control animal waste, petroleum fuel, petrochemical production, fertilizers, pesticides, and some medicines, the degradation of the environment will continue with the potential for even more complex catastrophes. Human Estrogenic Imprint on the Environment Katoria R. Tatum-Gibbs, Bobby L. Wilson and Renard L. Thomas. The environment and the ecology are extremely complex systems. The presence of endocrine disrupting compounds (EDCs) in the environment has become an increasing concern to environmental researchers. Among the EDCs emerging are natural and synthetic steroids, pharmaceuticals, and several industrially produced organic compounds. This research showed the existence of estrone, ethinyl estradiol and estriol throughout the Lower Galveston Bay Watershed in concentrations that pose a significant ecological threat to animals in the ecosystem. These compounds are attributed to the widespread use of oral contraceptives and natural human metabolic processes and pose a growing threat to the aquatic ecosystem. The ecological concern is that urbanization and the human ecological imprint threatens the ecological sustainability. The human ecological imprint is as important the economic and business components in the assessment of sustainability. Unfortunately, the limited awareness of the human ecology impact is too abstract and thus compromises the ability to address the problem. Urban Subsurface Infrastructure: Promoting Community Stewardship Robert L Ford, Ph.D. Were we to represent the urban subsurface in multi-layer graphical GIS format, few of us would recognize the complex maze of wires, cables, pipes, and tunnels beneath our feet. For many of our most populous urban areas, the invisible infrastructure carrying our drinking water, storm water and wastewater; telecommunications, electricity, and petroleum products have been buried for decades, surpassing their planned lifespan. Here, we present one strategy for prolonging the useful life of subsurface sewer system components, while promoting environmental responsibility and community activism towards local and global-sustainability. Engaging the complex network of public and private education and training enterprises to educate the general public about the multiple economic, environmental and health benefits of recycling fats, oils, and grease (' F.O.G.') while galvanizing the public into progressive action for the municipal production of biodiesel as a direct and sustainable alternative to offset the cost of imported, dirty, and expensive diesel fuels. In addition significant externality costs can be avoided while increasing the threshold for catastrophic occurrences.

Ranking Groups by Their Actions

Nathaniel Dean, Texas State University-San Marcos
Kiran Chilakamarri, Texas Southern University

The increasing availability of large amounts of information regarding terrorist activities and security of shipments amplifies the need for improved methods of analyzing and visualizing large data sets. In contrast to the usual statistical approaches our overall goal is to exploit graph models and graph theoretic methods to identify and understand the structure of covert networks. We also use visualization tools to aid in preliminary data analysis, reduce the ' information overload', and help human analysts concentrate on information that is most relevant to the situation at hand. This paper describes a new mathematical tool for criminal network analysis and other network analysis applications. We study systems (possibly physical, social, economic, biological, etc) where each object is represented by a node and each interaction (i.e., a relation, action or association) between two objects is represented by an edge. The types of interaction may vary including interactions that are social, racial, economic, sexual, religious, collaborations between departments, phone calls, or purchases at a store. We derive formulas for statistical parameters that can be used to rank groups based on the extent to which they act on or interact with others. These parameters can be computed quickly and hence can be used for a variety of applications that require either scalability or real-time, interactive analysis.

Long-range Prediction of Epileptic Seizures with Nonlinear Dynamics

Stephen J. Guastello, Marquette University
Henry Boeh, Marquette University
Mark Lynn, Marquette University

Patients with uncontrolled epilepsy have some significant difficulties with planning life routines, and thus one goal of the present study was to explore the viability of predicting seizures in time intervals of one week. The analytic strategy utilized the principle of dynamic diseases in conjunction with a cusp catastrophe model that was recently proposed. A seizure history of 124 weeks from one adult male patient fit both the cusp and fold catastrophe models (R2 = .92 and .88 respectively) reasonably well using the pdf method. Prediction of future states was possible, but somewhat compromised because of the nonstationary nature of the data and uncertainties regarding the control variables in the catastrophe models. Analyses of lag functions, however, revealed some surprising elements, suggesting that the precursory conditions for a seizure could be building up over a period of several weeks.

Catastrophe Models for Cognitive Workload and Fatigue

Stephen J. Guastello, Marquette University
Henry Boeh, Marquette University
Curt Shumaker, Marquette University
Michael Schimmels, Marquette University

Two nagging problems in human factors and ergonomics for the past two decades concern how to define and assess the qualitative nature of cognitive workload and demand levels, and to determine what combinations of tasks produce bottleneck conditions when performed together. A third separate but related problem concerns the separation of cognitive load, fatigue, and practice effects in evaluating

conditions leading to performance improvement or decline. The present research involves a new experimental paradigm for separating cognitive load and fatigue effects that builds on previous research that used the cusp catastrophe model as the central dynamic for describing change in performance. Total quantity of work performed, peak load conditions, and mental abilities that are non-central to the primary task are considered as bifurcation and asymmetry variables. The roles of the variables change depending on whether a load-performance or a fatigue-performance dynamic is considered.

Oligopoly on the Edge of Chaos

Aleksander Jakimowicz, Department of Macroeconomics, University of Warmia and Mazury, Olsztyn

According to conventional economics, the Cournot-Nash equilibrium constitutes a natural state of oligopoly. The achieved effect of convergence to equilibrium results from generally accepted practices in microeconomics which consist in reducing economic relationships to straight lines. Rejection of the linear paradigm seems to be a prerequisite if the theory of oligopoly is to be more realistic. Numerical explorations of selected nonlinear duopoly and triopoly models prove that there are two active kinds of economic forces in these market structures. The first of them, which has been described at length in microeconomics textbooks, leads market structures to the point of equilibrium determined by the intersection of reaction functions. The second, which is often omitted by economists, makes the path of equilibrium lead to the edge of chaos. In a short period, systems head for the Cournot-Nash equilibrium, however, in the long run, there is a drift along the points of equilibrium toward the edge of chaos. The source for each of these forces lies in the desire of producers to maximize profit. This objective is achieved through a reduction in marginal cost. Natural, i.e. due to economic reasons, drives of entrepreneurs initiate changes in control parameters of the system. Initially there are only transitions between different states of equilibrium. However, sooner or later there must be a bifurcation that accounts for an increase in the complexity of the system.

Recurrent Patterns of Daily Intimate Partner Violence and Environment

David Katerndahl, University of Texas Health Science Center at San Antonio
Robert Ferrer, University of Texas Health Science Center at San Antonio
Sandra Burge, University of Texas Health Science Center at San Antonio
Johanna Becho, University of Texas Health Science Center at San Antonio
Robert Wood, University of Texas Health Science Center at San Antonio

Although predictors of violent relationships have been identified, we are only beginning to understand the day-to-day dynamics of domestic violence. The objective of this study was to identify commonly seen patterns and strings of consecutive days involving verbal or physical abuse. Adult women (n=) seen in a primary care clinic who experienced violence within the past month were enrolled. Subjects completed a daily telephone assessment of household environment and marital relationship for two months using Interactive Verbal Response (IVR). Results were analyzed using orbital decomposition. While days without abuse had varied patterns involving arguments, stress levels, daily hassles, husband's alcohol intake, and sense of closeness (unique patterns), days involving verbal or physical abuse included a narrower range of patterns (patterns for verbal and patterns for physical abuse). Daily patterns clustered in triplets (consecutive days) of activity and showed nonlinearity with triplets involving verbal abuse and triplets involving physical violence. Triplets involving either verbal or physical abuse were associated with arguments and high stress, but differed in their association with hassles, alcohol intake, and closeness. Finally, physical and verbal abuse self-propagated. However, days involving verbal abuse did not precede days involving physical violence. In conclusion, while patterns of violence and household environments followed a nonlinear trajectory, only a limited set of patterns were observed. Although violence led to more violence, verbal abuse did not necessarily lead to physical aggression. Verbal abuse and physical violence differed in their relationships to hassles, husband's alcohol intake, and closeness.

Use of an agent-based model to understand Clinical systems

Luci Leykum, MD, MBA, MSc, South Texas Veterans Health Care System / University of Texas Health Science Center at San Antonio
Holly Lanham, MBA, McCombs School of Business
Michael Parchman, MD, MPH, STVHCS / UTHSCSA
Reuben R. McDaniel, Jr, EdD., McCombs School of Business

The application of chaos and complex systems theory to health care provides us with the insight that clinical systems are nonlinear. Because of the nonlinear dynamics between elements of clinical systems, uncertainty and surprise are inherent, and limits in our ability to plan and prevent systems errors are likely to exist. However, strategies to enable individuals to better act in the face of uncertainty may be important for improving clinical system performance. We explore the impact of relationships, sensemaking, and improvisation among physician teams as potential avenues to improve outcomes in health care settings. Based on in-depth observational study of inpatient general medicine physician teams, and the association between team function and patient outcomes, we developed an agent-based model to explore the impact of changes in physician team dynamics on patient outcomes through simulation. Specifically, we model the impact of variation in physicians' sensemaking and improvisation abilities on patient length of stay, the likelihood of a patient developing a complication, the need for transfer to a higher level of care, and death. Our model indicates that systematic differences in patient outcomes based on these physician attributes exists. Our model demonstrates that the use of agent-based modeling is a feasible method for simulating clinical settings, and suggests that physician group dynamics are important determinants of clinical outcomes.
Anticipating Disruptive Change with Futurist Techniques

Oliver Markley, PhD, Inward Bound Visioning
Constance Porter, PhD, St. Edward's University

Alternative futures research concepts and methods have much to offer systems-oriented practitioners in social and organizational psychology, economics and political science. Although it is true that prediction is not feasible in complex social systems, it is feasible to provide forecast specific alternative patterns that look most probable if current trends continue, as well as large-scale disruptive events (futurists call these ' wild cards'). With regard to the sustainability of civilization as we know it, we can, to use biblical language, ' look at the handwriting on the wall, and see what will happen to us if we don' t change our ways.' This workshop will begin with a brief pedagogical overview of conventional futures research concepts, such as alternative futures, forecasting vs. prediction, trend projection, emerging issue identification, wild card forecasting and disruptive impact assessment. A brief experiential exercise will be done for practical illustration. The contemporary field of futures research is itself changing due to the insights of complexity and chaos theory. These will be explored with the audience in a co-creative manner in which we all learn from each other as we discover new ways to use what we do for the benefit of a civilization that appears to be headed for a ' perfect storm' of crises.

Nonlinear Dynamics in Biopsychosocial Resilience

David Pincus, Chapman University
Annette Metten, Chapman University

Theory and methodology from nonlinear dynamical systems (NDS) may provide considerable advantage to health scientists as well as health care professionals. For instance, NDS methodologies and topics in health care share a focus upon the potentially complex interactions of biological, psychological and social factors over time. Nevertheless, a number of challenges remain in creating the necessary bridges in understanding to allow researchers to apply NDS techniques and to enable practitioners to use the resulting evidence to improve patient care. This paper aims to provide such a bridge. First, common concepts pertaining to self-organizing complex adaptive systems are outlined as a general approach to understanding resilience across biological, psychological, and social scales. Next, four data analytic techniques from NDS are compared and contrasted with respect to the information they may provide about some common processes underlying resilience. These techniques are: time-series analysis, state-space grids, catastrophe modeling, and network modeling. Implications for health scientists and practitioners are discussed.

Modeling Language Development from Self-Organization of Gestalts and Metaphor

David Rail, Neurologist, Private Practice

According to cognitive linguistics the continuous and dynamic form of the external, phenomenal world motivates gestalts as an expression of the unity of perception and language. These semantic sentential structures represent the self-organization of image schemata, where gestalts acquire meaning through metaphor. We propose that language development can be modeled in terms of this progressive self organization between metaphor and gestalts. To develop the model metaphor needs to be conceived as coordination of the master tropes, or a tropology. The significance of the topologic basis stems from two crucial findings. First, we show how the tropology functions in a gestalt manner. Second, how perception functions tropologically. We indicate how semantic sentential structures (gestalts) are generated from the tropology. Finally, we outline the model in terms of the recursive function of the tropology throughout the forebrain, from perception to the frontal regions.

Control, Learning and Innovation: A Syncretic Approach

Carmen Romo de Vivar, Interdisciplinary PhD student UT Austin

This research focuses on understanding the processes involved in successful innovation' a topic that has appeared in a large body of research, but no conclusive trend has emerged about it. For this reason, I chose a different lens -Complex Adaptive Systems lens- in order to gain a more panoramic view of the events leading up to an innovation. In particular, this research utilized a methodology and ontology that set it apart from previous work. In previous research control/exploitation and learning/exploration are either presented as two categorically separate concepts or as continuum that runs between them. This research supports the idea that innovation operates on a continuum but does not support the idea that it only occurs when the pendulum settles toward the learning/exploration side. Instead, the data shows that innovation could indeed occur at any point along the learning/exploration side of the continuum and even at the central point where learning/exploration and control/exploitation weigh evenly. To conceptualize this middle point, I term this a ' syncretism' of two normally opposing forces to account for a significant portion of the interview data.

A Method to Construct More Complex Models of Agent Behavior

Sara Nora Ross, Antioch University Midwest

When we use tasks as a basic unit of analysis, and have a method to measure tasks, a new world for agent modeling may open up. A robust task measurement method enables predictions of the structure (but not content) of future possible tasks in conditions agents may find themselves in. The model of hierarchical complexity is a math-based general theory of behavioral development that supplies such a measurement method. The current limitations of agent modeling are explained in terms of task complexity. This application of hierarchical complexity measurement is as applicable to

organizational development issues as it is to agent modeling. Differences in task complexity involve measurably-different kinds of variables, which, when coordinated, result in more creatively emergent behaviors. These variables and their coordination demands in modeling and prediction are introduced. Implications of task complexity modeling for programming as well as consultants are discussed.

Science, Scientists and the Dharma: Emic & Etic Perspectives on Culture, Philosophies of Science and Complexity

Robert Steiner, University of Louisville School of Public Health & Information Sciences

Scientific inquiry is a distinctly human activity, involving scientists and their theories in relation to phenomena. Positivism prevails within scientific reports, whereby phenomena are viewed as independent and self-existing - distinct from the observer - despite evidence from complexity to the contrary. Yet, scientists are enmeshed within their culture and explanatory models, unaware of alternative perspectives on the nature of reality. Philosophies from other cultures pose different assumptions about the nature of reality. They may provide enriching perspectives to guide development of new insights. For example, the Two Truths of Tibetan Buddhism provide alternative perspectives, such that the Mind Only School describes relative world phenomena as projections of mind - magical displays that lack self-existing, inherent nature - despite appearances to the contrary, while the Madhyamaka School poses that absolute reality is beyond concepts, free from all dualities, inexpressible - yet such can be realized with mindfulness practices. The focus is on cultivating natural mindful qualities of human experience. From this etic view, theories and scientific methods appear to be culturally-bound, limited by habitual patterns of mind that only perceive dualistic appearances of the relative world. Properly motivated scientists may engage in mindfulness training to directly experience the inexpressible via non-conceptual direct valid cognition, as taught in Madhyamaka practices. Applying transcendental humanism with scientific methods may offer scientists new possibilities for cultivating means to beneficence. Studies of cultural relativism and philosophies of science may facilitate an awareness of implicit assumptions and limitations within western sciences, so providing new modes for study and action to benefit societies.

Why Smart Leaders Make Dumb Decisions: A Catastrophe Explanation?

Dick Thompson, High Performing Systems, Inc.

The ability to make sound and timely decisions is the mark of a good leader. However, when leaders with otherwise strong track records suddenly begin making poor decisions---as seen in the recent BP oil spill and General McChrystal---the impact can be devastating. This presentation presents theoretical evidence that catastrophe models may be useful in understanding and predicting "dumb decisions."

Using Randomness to Reveal Patterns in Eye Movements

Doug Preddy, University of Central Oklahoma
Mickie Vanhoy, University of Central Oklahoma

There is currently a divide in visual search literature with regard to memory and visual search patterns. The amnesic model of visual search represents one side, where no memory exists and eye movements are random. The other extreme is that representational memory plays an integral role in visual search patterns. Another hypothesis is that history affects eye movements in a nonlinear way. Traditional methods of analyzing eye movements treat each trial as a separate entity. Results that indicate that eye movements are random may be an artifact of linear statistical analysis. However, time series analysis may reveal nonlinear patterns using the same experimental methodologies used in detecting apparently random data. Participants viewed a search prompt (appearing before, after, or simultaneously with a stimulus array), searched a stimulus array (composed of four, five, six, seven, or eight shapes), and indicated target presence or absence. Stimuli were conjunctions of squares, circles, and lines in a horizontal, vertical, or diagonal orientation. All stimuli appeared near the edges of the computer screen, distal to the search prompt. The number of distracters varied and each color-shape combination appeared only once per slide. Traditional analyses indicated no difference between different conditions, putative support for the amnesic model. However, nonlinear methods (Wavelet Transform Modulus Maxima analysis) indicated underlying eye movement structure' multifractality in eye movements over time supports the hypothesis that history affects eye movements.

The Period 3 Window: a New (and Very Old) Key to Nonlinear Computation

Katya Walter, Institute for Neuroscience and Consciousness Studies, Austin, TX

The period 3 window in a bifurcation tree is the key defining signature of chaos patterning - as proved mathematically by James Yorke and Tien-Yien Li in their seminal paper "Period Three Implies Chaos." This presentation examines the period 3 window in two very different systems - (1) the genetic code found by Watson and Crick in 1953, and (2) a 5,000-year-old mathematical system called the Chinese I Ching. DNA is physical; the I Ching is metaphysical. Genetics is new knowledge; the I Ching is very old. DNA codes for organic matter; the I Ching claimed to track the Tao as world mind. How can two such unrelated topics - matter and mind tracked in cultural heritages so far apart in space and time - echo each other in their math functions? Here is the answer. Both are

based on the same fractal code of "co-chaos" patterning. This shared code uses period 3 windows to develop nonlinear equations that structure both systems - the ancient I Ching hexagrams...and the modern DNA swatches of the genetic code. This meeting of East and West is due to their shared fractal code. It provides both I Ching and DNA with a fail-safe supersystem which assures stability plus leeway for evolutionary change. This talk also speculates on further possible applications for this distinctive co-chaos signature, including in string theory and developing a unique hybrid computer that utilizes both binary and analog processing.

Could the Arrow of Time be a Strange Attractor?

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The butterfly-like double bubble shape of the Lorenz oscillator is a key icon in deterministic chaos. This paper and PowerPoint presentation suggest the possibility that our universe is itself a living dynamical system of two domains in a giant Lorenz oscillator, according to applied string theory. Complementarity in the laws of physics allows such a possibility. A double bubble universe could account for the continually emerging chaotic flow of events subject to abrupt, seemingly random changes, but perhaps fully deterministic in emergent nonlinear progression. Regard the huge twins of this double bubble universe. One domain exists above the Planck level. It has space-time, i.e., three-dimensional space and one-dimensional time, plus matter, energy, and our known gravity pole. Three-dimensional space provides its three ODEs - ordinary differential equations. But the domain below the Planck level holds time-space, i.e., three-dimensional time and one-dimensional space, plus antimatter compressed into tachyonic energy, and the lost gravity pole. Three-dimensional time provides its three ODEs. But what of the solitary dimension in each domain? This theory suggests they are actually half-dimensions. They bond across domains into a strange attractor, giving the eleven dimensions of superstring theory. Right at the Planck level are multitudinous tiny cellular interfaces of Mobic two-dimensional space and two-dimensional time. Each constantly-reorienting loop on its infinite path emits the graininess of quanta. It all creates a giant Lorenz oscillator caught in a Klein bottle. Thus in this theory, we live in a Klein bottle universe built by nonlinear chaos.

Controlling Chaos in the Human Nervous System

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Intensive study spanning years regarding the concern that the Chaos, observed in the nervous system of all subjects, % of the time is responsible for any disorder or despair that presents in the physical/emotional representations of the individual. The rationale is based on the fact that living systems rely on the ' proper functional' capacity of sensitive feedback loops that enable precision ' tuned in' communication with and responses to the outside world-environment. Intrinsic ' self organizing' properties of the nervous system enable continually upgrading and recalibration of the system via ' bifurcations' to enhance resilience, survival and creative evolution. ' Attractors' that signify the stability of the system in response to environmental stimuli are modifiable through experience (world noise). An individual' s physical participation in the environment and their perception of their environment, be it real or imagined, assists to orchestrate neuro-modulating effects. The net result being that the system will present either in a state of growth or a state of protection. It is however during ' long term' states of protection- hyper vigilance of the sympathetic nervous system through positive feedback- that random inhibition of the nervous system, resulting from the diminished ability of the parasympathetic nervous system to supply negative feedback, contaminates the ' proper functional' capacity of the system, manifesting extreme ' sensitivity to initial conditions' . The ability of the nervous system to coordinate and manage all life sustaining functions down to cellular levels is compromised under these conditions. Any disease or disorder present in the system is a direct result of the chaotic breakdown of communication within the system. The workshop will demonstrate special techniques that allow the therapist ' Neurotrician' to assess with the subject the ' Chaos' in their nervous system. Their ' sensitivity to the initial' conditions are observed as random inconsistent responses to a mild stimulus, producing spastic shaking that is inconsistent in velocity and unpredictable and very out of phase with the thoughts and motives of the individual, who is being coached to relax. At speed it is almost impossible to detect the chaos; this is the speed that the individual usually functions at, however, by slowing them right down with a mild stimulus it is easy to witness how chaotically the person's nervous system metabolizes all sensory input through the integration of the association cortex. The workshop will show techniques that allow the persons nervous system to ' self organize' to reproduce stable responses to environmental stimuli. The person notices with in a very short period of time that they also have control over physical/emotional disturbances or have dramatically improved performance goals (for example athletically). The workshop introduces the ' Neurotrician' as the first Chaos Theory Nonlinear Dynamics Therapist, assisting people to improve their physical and emotional potential by controlling Chaos on their nervous systems. The many successes of the technique will be discussed. The technique also gives other researchers a reliable base to draw many conclusions from. The possible use of the technique to assess necessary chaotic drug interactions is just one.