Society for Chaos Theory in Psychology & Life Sciences

NEWSLETTER

Conference Abstracts Issue Vol. 10 No. 4, August, 2003

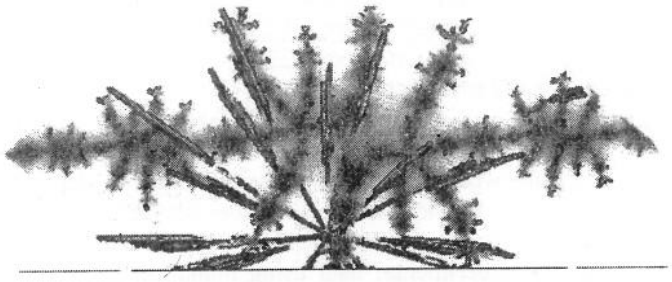
New Publisher for

Nonlinear Dynamics, Psychology, and Life Sciences

Beginning in January 2004, *NDPLS* will be published directly by the Society for Chaos Theory in Psychology & Life Sciences. The plan includes both print and electronic availability and the same variety of reader and abstracting services that has evolved to date. The scope and content of the journal will remain the same, although there will be additional efforts to represent topics in nonlinear dynamics that have been underrepresented in the past.

NDPLS' inaugural issue was released in January 1997 under contract that was signed in December 1995 with Human Sciences Press, division of Plenum Publishers of New York. Kluwer Academic Publishers bought Plenum, and the contract, in late 1998. The contract was scheduled for renewal in 2003, but Kluwer informed our Editor last year that they did not intend to renew the contract, which was scheduled to run through October 2006.

After studying a variety of options with commercial academic publishers, university presses, and self-publication scenarios during the past year, it became clear that the most cost-effective way for the Society to produce the journal, and to manage its growth, was to take the self-publishing route. Society members should be happy to learn that no increase in dues will be necessary to make this transition, according to Stephen Guastello who will be continuing as the Editor in Chief for *NDPLS* and the Society's Treasurer.



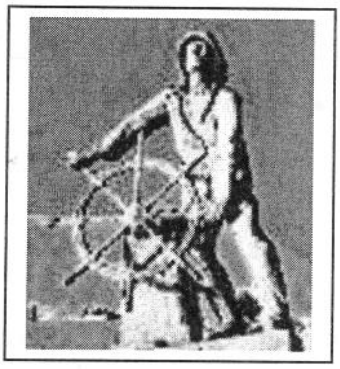
He continues, "One of the benefits of the self-publication route is that we no longer have to deal with the corporate shenanigans that have stifled our growth in the recent past. Not only was HSP/ Plenum bought by Kluwer in late 1998, Kluwer Academic itself went up for sale in April 2002 and was sold to a consortium of two investment banking firms in October, 2002. Throughout the Kluwer years we received little support in the way of abstracting services or institutional sales or promotion. Any accomplishments in the way of abstracting and visibility we made ourselves. Institutional sales were supposed to be the prerogative of the publisher, but they played only a passive role. By late 2002 Kluwer was publishing over 700 different journals between their social science and their natural sciences topics. There was only so much they could do specifically for us."

According to the transition plan between SCTPLS and Kluwer, Kluwer will continue to service the electronic institutional subscriptions that they have already sold. The institutional subscriber list, both hard copy and electronic, will be turned over to the Society for Volume 8 and future volumes.

Kluwer now has the complete contents of Volumes 1 through 7 (October 2003 has yet to appear) available on its *CONTINUED ON PAGE 21.*

Ruth Mateos de Cabo Captures New Members, Wins Prize

Ruth Mateos de Cabo was announced the winner of the lottery for members who bring in new Society members. The program started in December, 2002 and provided a chance on a lottery for all members who brought in a new Society member under the program. The prize was a free conference registration at the 13th Annual International SCTPLS conference in Boston.



SCTPLS 2003 Conference Abstracts

Alphabetical Listing by First Author

Boston, MA, USA Aug 8-10, 2003

**Please note: This list identifies the session in which a paper will be presented. To see the ordering of papers within the session, consult the overview of the full schedule. **

Susan C. Aaron, University of Toronto, *susan.aaron@utoronto.ca*
Sat 18:15 Poster Session, Outside Rooms 426-430
Where Are We Natural - Creativity as Exemplary of Human Action Removed from Natural Patterns
If novel structure is the product of an act of creativity that emerges by breaking a chaotic pattern - (Sabelli & Abouzeid, "Definition and Empirical Characterization of Creative Processes," Nonlinear Dynamics, Psychology, and Life Sciences, January 2003) then is the propensity of creativity in human beings evidence of a knowledge structure that is constructed continually apart from the natural as a chaotic pattern is considered to be based on natural structures? And if digital technology is continually linking creative actions does it increase this network in abeiance of chaotic patterns to arrive at some new form of stability or homeostasis? Perhaps one might make this observation in the example of a human technologically mediated performance, where the concurrent patterns of persons broadcast globally but reoriented in the transmission by technologies alter the nature of creating patterns so that the notion of patterns itself as the basis for knowledge created from the proprioception of human bodies is altered, Does this action emphasize this removal from "nature" as the human body in their creation? What are the implications of this? Does this tell us about the nature of knowledge, creativity, and reflect on humans as doers of nonnatural acts while bearers of natural dynamics, and does this information allow us to be more aware of what we are calling natural and what is otherwise for the clarification of both?

Hossein Abbasi Nejad, Economics, University of Tehran, *habasi@ut.ac.ir*
Shapour Mohammadi, Economics, University of Tehran, *Shapoor22@hotmail.com*
Sat 9:00-10:30 Session, Room 224
On the Attractors of Structural Change
We report results of over 18 months study of the attractors of structural change for NICS. Existence of attractors in the economics' structural change and their estimation are our main interest. The results imply that the countries consume longer in some structures than the others. This can be interpreted as existence of attractors that pull countries to themselves in the first stage of the development. In the other words one attractor (low level attractor) prevent countries to reach industrial structure. Awareness of this can be helpful in policymaking for transition from one structure to another. This analysis shade light on the problem that why some countries can not get ride of traditional structure.

Charles Adamson, School of Nursing, Miyagi University, *adamson@myu.ac.jp*
Sat 18:15 Poster Session, Outside Rooms 426-430
Linguists Can't See the Forest for the Trees
What is language? In order to solve this tough problem, linguists develop models of language (grammars) based on perceived regularities in the language they observe. Applied linguists then try to find ways of teaching these regularities to students or apply them to other fields such as natural language processing on computers. This model is based on three simple observations: [1] all linguistic features have prerequisites, [2] language input must be meaningful to become internalized, and [3] language features are fuzzy. The resulting model is a complex network of interlocking trees, technically a forest, which represents Chomsky's language acquisition device (LAD). The model will be presented and then some of the implications will be discussed.

Eizo Akiyama, Institute of Policy and Planning Sciences, University of Tsukuba, *eizo@sk.tsukuba.ac.jp*, http://infoshako.sk.tsukuba.ac.jp/~eizo/
Sat 9:00-10:30 Session, Room 224
Avatamsaka Game Dynamics
Avatamsaka game is investigated both analytically and by means of computer simulations. (Two-person) Avatamsaka game is a game where each agent's payoff completely depends not on her own decision but on the other player's, thus any combination of mixed-strategies is Nash equilibrium. However, the experimental data using human subjects have

shown that the distribution of players' actions in this game has a certain tendency. The mechanism to reveal the origin of the empirical distribution is presented from viewpoint of game dynamics including agents' cognition update process.

Gary Bodie, Department of English, University of Oregon, *gbodie@darkwing.uoregon.edu*
Sat 14:00-15:30 Session, Room 220
Pleasing Form: Complex Aesthetics in Beowulf
This paper will use recent advances in the applications of chaos and complexity theory to examine the poetic text of Beowulf. Cognitive science, linguistic theory, narrative theory and literary criticism are all beginning to use complexity theory to explore the ways in which a text transmits (and a mind constructs) meaning; it is my argument that these disparate fields converge through this common approach into a new understanding of how aesthetic appreciation operates. Because Beowulf has long been valued as a work of art and is also known to be a complex and chaotic text (in the traditional, nonscientific sense), it provides an ideal subject for this study. By mapping the narrative in both its macro- and micro- scales, I will demonstrate the fractal structure of the text and will argue that it is this structure which contributes to its reception as an aesthetically pleasing work of art. Because chaos theory describes natural systems across all scales, from molecular to galactic structures—in other words, is a mathematical formulation of the forms and motions of nature—I will argue that it also describes the forms which underlie this text (a text which may be more representative of a natural poetics than any other in the English canon) and the motions of the cognitive process of aesthetic reception.

Don M.M. Booker, School of Computer Science and Information Systems, Pace University, NY
DBooker@Pace.edu , DonBooker@aol.com
Sat 18:15 Poster Session, Outside Rooms 426-430
What Is Information? Information Is Fractal and Chaotic
This paper will review several mathematical models which answer the question, "What IS Information?" and suggest that they may share a common framework which is characterized by recursive and self-similar aspects. Shannon Weaver communications theory, dynamical systems models, computational complexity models, Chaitan Kolmogorov algorithmic information theory, Renyi information, and Demski's specified complexity model will be briefly reviewed and discussed. Issues related to the contextualization of meaning will also be discussed in the context of statistical methods such as Demski's aimed at assisting in this effort.

Don M.M. Booker, School of Computer Science and Information Systems, Pace University, NY
DBooker@Pace.edu , DonBooker@aol.com
Sun 11:30-12:30 Session, Room 220
Is Information Conserved? Can 'New' Information Be Created?
This paper will examine several approaches to formulating and proving a conservation theorum for information, using Boltzman entropy and the second law of thermodynamics, perspectives from "Physics from Fisher Information", Chaitan algorithmic information theory, 'no free lunch theorums' and evolutionary search and learning arguments. The implications of an information conservation theorum for the 'creation' or origination of 'new' information will be explored and some proposed sources of 'creative' or 'new' information will be examined including random and parallel search algorithms and methods, symetry breaking, prior pattern based or genetic heurestics, and information viewed as an experiment or measurement,and as a symetric and asymetric game.

Clifford T. Brown, Middle American Research Institute, Tulane University, *BrownC@navfac.navy.mil,*
http://web.dandp.com/enviroweb/cultural/
Sat Evening Keynote, Rooms 426-430
Dynamics and Patterns in the Rise and Fall of States: Problems and Data
Theories of human cultural evolution, and in particular those that purport to explain rise of the state, have been slow to integrate nonlinear dynamical systems theory (NDS). Nevertheless, it does appear to be necessary to include NDS in any satisfactory description (much less explanation) of the general trajectory of cultural evolution. I discuss prevailing theories of cultural evolution and their weaknesses; I describe the characteristics that I believe an adequate model of cultural evolution should possess; I explain some of the fundamental problems with the archaeological and historical data; and I suggest ways in which nonlinear science can contribute to the empirical solution of these complex problems.

Gerardo Burkle-Elizondo, Centro Interinstitucional de Artes y Humanidades, Universidad Autónoma de Zacatecas, México, *burklecaos@hotmail.com*
Ochoa-Santos Miguel, Centro Interinstitucional de Artes y Humanidades, Universidad Autónoma de Zacatecas, México, *consolo@terra.com.mx*
Terán-Elizondo Isabel, Centro Interinstitucional de Artes y Humanidades, Universidad Autónoma de Zacatecas, México, *iteran@cantera.reduaz.mx*
Sat 18:15 Poster Session, Outside Rooms 426-430
Fractality in the Main Characters of a Long-Range Literature
The quantitative information about the use of words in the structure of a text had been studied using the Zipf´s analysis. There are complex hierarchies at micro and macrostructures of long-range lenguage to get a coherent message. Some of them belong to syntactic and grammar rules. The place and link of grammatical figures like pronouns, verbs, nouns, articles etc. wich fractal correlations distribution are well known.

The aim of this work is to investigate if in a very long-range sequence of literary corpora, in the use of the word that is the name of the main character in the text, this is a dynamic distribution in the quantitative and statistical way. To make it we choose the first two chapters of a novel, with a total number of words in the set up to 11 126, from Vincenzo Consolo´s "La sonrrisa del ignoto marinero". Like an axis the two main characters are the "Barón" that appears 71 times, and the "marinero" (the same that "Interdonato" and the "comerciante") 63 times. In the first analysis we calculate the fractality of a series about the ocurrence of anybody of the "Barón" or the "marinero", and the number of words between each time that one of them appears. We found a Df 1.929 ± 0.357 with r2 0.806. In a second analysis we calculate the

fractality of a series about the way that the "Barón" and the "marinero" mix each other , counting the words number between each time that the "marinero" appears, and the same about the "Barón". We found Df 1.827 ± 0.669 with r^2 0.882.

This novel is an historical one. It breaks with linearity with a "polyphony" narrative style. The recursive frequency design could have linguistic relevance in the brain codex system and the communication process.

Gerardo Burkle-Elizondo, Centro Interinstitucional de Artes y Humanidades, Universidad Autónoma de Zacatecas, México, *burklecaos@hotmail.com*
Sat 11:00-12:30 Session, Room 208
Complexity in the Mesoamerican Myth of Quetzalcoatl

In the Mexica and the Mixtec traditions from Mesoamerica about the genesis, the Quetzalcoatl god, the plumed serpent moves along different dimensions in his travel to the underworld (Tlalocan). He dies, but to bring back to life with a human soul in a holy nature, because he is a man that becomes a god through self-sacrifice. He was born like the "star of the morning" (Venus) in order to become one with the Sun in the process of creation that gets moving from the upper world (Tamoanchan).

Archaeologists make the description of the relationship between this myth present in the prehispanic codex of Borgia, Féjerváry-Mayer and Florentino, with the ritual space of "Tula" city like a place in which in the earth, the adventure of Quetzalcoatl come true like a holy and ritual architecture that represents here, the upper and the underworld. I found a relationship of self-similarity between these three spaces: the mythic one, the codex and the Tula city with its pyramids and ball game like the trajectory of an attractor that is Quetzalcoatl himself –who dies and bring back to life- Venus- the Sun- the life, all this inside a 52 year period (xiuhmolpilli).

From this recursive process with these space-temporal patterns of cusp catastrophes life-death-resurrection in which we find chaos, entropy and turbulence, finally the morphogenesis on brow appears with the born of Venus, the Sun, the man and the world. A complex space has now structure in a trajectory of a cosmic-creative space myth-codex-Tula that, like a process of cosmic movement, emerges in a non-linear time. The aims of the present study is to show the complex relationships that exist between this prehispanic knowledge with some concepts of Complex Dynamic Systems, making a comparison between the images of the codex, the buildings and structures of Tula city and the myth.

Sary Levy Carciente, IIES-FACES-UCV, Economics and Social Research Institute 'Rodolfo Quintero', Central University of Venezuela, *econofin@cantv.net*
Hector Sabelli, Chicago Center for Creative Development, *Hector_Sabelli@rush.edu,* http://creativebios.com
Klaus Jaffe, Universidad Simón Bolívar, *kjaffe@usb.ve,* http://atta.labb.usb.ve/klaus/klaus.htm
Rafael Rodriguez, Universidad Central de Venezuela, *rotoledo@tutopia.com*
Sat 9:00-10:30 Session, Room 224
Complex Patterns in the Oil Market

Nonlinear dynamic analyses show that the pattern of the time series for the prices and volumes of Brent crude oil sold in the London International Exchange shows asymmetry, diversification, low recurrence, novelty, nonrandom complexity, and defined periods where specific attractors are at work. The series of differences between consecutive terms in oil prices and sales volume show biotic-like pattern, demonstrating that changes are not random nor chaotic. These results suggest that oil markets may be more influenced by human decision-making processes than by physical constraints in supply and demand. Nevertheless, they show highly structured organization that are detectable with unconventional methods of analysis explored here.

Ken Colwell, Department of Management, LeBow College of Business, Drexel University, PA, *ken_colwell@yahoo.com*
Alan D. Meyer, Management Department, Lundquist College of Business, University of Oregon, *ameyer@lcbmail.uoregon.edu*
Sat 16:00-17:00 Session, Room 224
Fractal Dimensions in Interorganizational Alliance Networks

Much attention has been given in recent years to the "scale-free" topology of networks. A scale-free network is one in which the distribution of links between nodes is not normally distributed. Such a network consists of a few densely connected "hub" nodes, while most nodes have few connections. This structure has been found to be persistent in a variety of networks comprised of very different node and link types. In a prior study, we found that the scale-free topology is also present in the alliance network of organizations in the nascent field of nanotechnology. In this study, we suggest several ways of describing the dimensions of a complex interorganizational network and show that the scale-free topology is self-similar with respect to these dimensions. Methodological implications for the study of organizational alliances are discussed.

Catherine Dibble, University of Maryland, *geographs@earthlink.net,* http://www.glue.umd.edu/~cdibble/
Fri 13:30-17:30 Workshop, Room 208
Agent-Based Computational Laboratories
See Workshop Descriptions (*Newsletter April, 2003*)

Dimitar Dimitrov, Department of Economics and Finance, Institute for Advanced Studies, Vienna, *dimitrov@ihs.ac.at*
Victor Dorofeenko, Department of Economics and Finance, Institute for Advanced Studies, Vienna, *dorofeen@ihs.ac.at*
Yuri Yegorov, Institute for Advanced Studies, Vienna, *yegorov@ihs.ac.at*
Sat 16:00-17:00 Session, Room 224
Demographically Induced Land Fractals and Political Tension

We study the phenomenon of land fragmentation in the process of inheritance given heterogeneous fertility across population. In this framework, initially homogenously distributed land evolve and asymptotically form a fractal with

power law within wide range of wealth. When the smallest land endowments touch critical values, the process of land redistribution and accumulation via market and non-market mechanisms starts, and leads to increased political tension. We analyse the data of land distribution for different countries and find power laws there as well as correlation between powers and political situation.

Kevin Dooley, Arizona State University,
Kevin.Dooley@asu.edu,
http://www.eas.asu.edu/~kdooley/
Steven Corman, Arizona State University,
Steve.Corman@asu.edu
Sat 16:00-17:00 Session, Room 220
WORKSHOP: Modeling Longitudinal Dynamics in Textual Data
Many social phenomena create a time series of texts. Emergent social events and processes are captured in newspaper articles, emails, reports, and conversations. Theoretical insight can be gained by studying the underlying dynamics of the longitudinal textual data. For example, thematic periodicities may indicate strong institutional influences. We shall present a general methodology for the analysis of such data, and demonstrate it in a number of contexts.

Mark R. Filippi, Living Lessons - An Instructional Self-Care Center, *addchiro@mindspring.com,*
http://www.markfilippi.com
Sat 11:00-12:30 Session, Room 224
Healing Through Sentience - Breaking the Cycle of Intervention
In 2000, I published a prospective paper in the Journal of Vertebral Subluxation Research that declared non-linear dynamics offered clinical tools to design what I termed a virtual adjustment. Using the principles of phylobiology, it was proposed that - "by resolving the dilemma of self-reference, we can expand our access to autopoiesis to a non-local level and allow the process of autosuggestion to sort for memes that increase our collective and personal coherence." JVSR 3(4), 1999-2000. Several clinical models were then templated.

This spring, I am conducting a 90-day preliminary trial of a nonverbal skill transference program developed through the intervening years that uses visual and postural development as resources in guiding clients to regaining their vitality and recuperative power. The central feature of this system involves directing the client to an awareness of their visual-postural dynamic (VPD). The VPD consists of six discrete interactive tasks the doctor and client perform to access an undifferenciated consciousness, AKA, sentience. The unique contribution of the VPD is that it places the emphasis on interpersonal aspects of healing. This takes the myope, amblyope, what have you, beyond their limitations, literally into the living mirror of their daily lives.

This clinical application, which has been dubbed, Behavioral Chiropractic, uses several aspects of non-linear dynamics to study and evaluate the client's level of integration. I'll discuss how this was accomplished on a low-tech level, using psychomotor performance parameters and other simple somatic markers. A composite summary of my trial's results to date will also be presented. Key Words: neuroception, henomenology, sentience, ntosomatic, biosemiotics

Charles A. Fink, Behavioral System Science Organization, Falls Church, VA, *cfink@cox.net,*
http://www.behavioralsystems.org
Sun 9:00-10:30 Session, Room 224
INTERACTIVE DEMONSTRATION: Elicitation to a Deconstructed-System for Human Behavior Study
I give a brief scientific introduction, with coupling to SCTPLS interests, and then an interactive demonstration of eliciting ("canned" for privacy) from a volunteer functional determinants of his/her behavior for a given event, situation, or condition. Elicitation is recorded within functions of the author's Human Behavior System on preprinted whiteboard and captured electronically in real time to computer, where a researcher or other professional annotates whiteboard elicitations as they are computer-displayed so as to highlight potential problems in behavior-determining processes. Then the researcher plays back on computer a more-or-less a movie of whiteboard elicitations and annotations so that he/she and the volunteer may discuss problem areas uncovered.

Pawel Frankowski, Department of Political Science, University of M.C. Sklodowska,
pfrankow@sokrates.umcs.lublin.pl
Sat 16:00-17:00 Session, Room 208
Control Or Not? Hegemony Through the Lens of Chaos Theory
Author explains what is role of the strongest actor in chaotic system of international relations. Author adopted Callen-Shapiro's theory of social imitation and Vaga's theory of coherent market for international relations and created dimensional model of IR Author assumes that inspite of self-organizing character of international relations, system needs hegemon for stabile developement and exiting of hegemon sets system in state of dynamic equilibrium. Author bases on two hypopthesies: 1. Accordingly to growth of state's attractiveness (in military, politic,cultural areas) and state potential, international support for its action increase; so that, state/hegemon could control system of international relations in easier way. 2. Growth of state's power means that homeostat's principle is broken because strongest state both stabilizes and destabilize system, i.e. states can control and cause chaos.

Walter J. Freeman, Department of Molecular and Cell Biology, University of California,
wfreeman@socrates.berkeley.edu,
http://sulcus.berkeley.edu
Sat Evening Special Award Address, Rooms 426-430
Where can chaos theory take us? Where do we want to go?
Chaos theory hit psychology like a thunderbolt. We were blinded by the flash of insight and enthralled by arcane technologies borrowed from deterministic chaos. We stumbled badly over correlation dimension and the rigidity of basin-attractor theory. Now these youthful excesses are behind us. We have a wonderful opportunity to document the creative dynamics by which brains organize themselves in

assimilating their environments. Advances can come by applying chaotic dynamics to brain images from subjects who report the meanings of their experiences. The greatest source of new knowledge is the scalp EEG: inexpensive, easy to acquire, comfortable for subjects, and incredibly rich in heretofore unintelligible detail.

Walter J. Freeman, Department of Molecular and Cell Biology, University of California,
wfreeman@socrates.berkeley.edu,
http://sulcus.berkeley.edu
Sun 11:00-12:30 Session, Room 208
Scalp EEGs Reveal Large Spatial Patterns with the Texture of Gyri in Frames Flickering at the Speed of Thought
Sensation and perception both require dendritic currents and axonal action potentials of neurons that are widely distributed in the forebrain. The spatiotemporal neural activity patterns in sensation differ dramatically from those in perception. Sensation is mediated by action potentials of feature-detector neurons observed with microelectrodes and modeled with neural networks. Perception is formation of large-scale patterns of coordinated action potentials from millions of neurons. Patterns are modeled as densities in a continuous sheet and observed with electrode arrays to record the EEG from the dendritic currents that control the action potentials.

A two-stage mechanism is proposed by which sensory cortical activity that is stimulus-driven by receptor input induces hemisphere-wide, self-organized patterns of perceptual neural activity within 300-500 ms of stimulus onset. In the 1st stage sensory input destabilizes the primary receiving areas, so that the random microscopic action potentials condense into a wave packet, like a raindrop formed from water vapor.

The 2nd stage occurs as wave packets from all sensory areas are carried by action potentials through the forebrain. The dendritic integration of activity destabilizes much or all of each hemisphere, and a global pattern emerges. Such patterns have been observed in animals by intracranial recording of EEG from multiple areas, and noninvasively in normal humans by multichannel scalp EEG. Observation with common clinical equipment is facilitated by dense electrode arrays for high spatial resolution and the Hilbert transform for high temporal resolution. The patterns provide access to the synchrony used by the brain in high-level cognitive functions involving perceptual experience.

Kenkichi Fukurotani, Engineering, Toyama University,
kenkichi@iis.toyama-u.ac.jp
Dusit Thanapatay, *thanapatay@hotmail.com*
Sat 18:15 Poster Session, Outside Rooms 426-430
Synchronous Period-doubling in Flicker Responses of Retinal Neurons
We studied nonlinear dynamics of horizontal cells and transient-type amacrine cells in the goldfish retina. We recorded intracellular responses of horizontal cells and amacrine cells to periodic flashes of light. The neurons exhibited period-doubling bifurcation and chaos when periodic frequency of the light flashes varied as a parameter. The period-2 orbit appeared at frequency of 25 Hz for monophasic-type horizontal cells, 20 Hz for biphasic-type horizontal cells, and 15 Hz for triphasic-type horizontal cells. Transient-type amacrine cells bifurcated at the same frequency as that of monophasic horizontal cells for period-2 obit. The bifurcation phenomenon of horizontal cells did not depend on spot size of flash light. Therefore, we concluded that the bifurcation originated at postsynaptic level of horizontal cell dendrites at ribbon synapses between cone photoreceptor basal ends or even at cone photoreceptor level.

Ricardo Gimeno Nogués, Department of Quantitative Methods, Universidad Pontificia Comillas,
rgimeno@cee.upco.es,
http://www.upco.es/personal/rgimeno/default.html
Ruth Mateos de Cabo, Department of Business Administration, Universidad San Pablo-CEU,
matcab@ceu.es
Miguel Angel Pelacho, Department of Humanities,
MPELACHO@terra.es
Elena Olmedo Fernández, Department of Applied Economics, University of Seville, *olmedo@us.es*
Lorenzo Escot Mangas, Department of Applied Economics, Universidad Complutense,
escot@ccee.ucm.es
Pilar Grau Carles, Department of Economics, Universidad Rey Juan Carlos, *grau@fcjs.urjc.es*
Sun 14:00-15:30 Session, Room 224
Lyapunov Tests for Short Time Series
Lyapunov Exponents are common tools in order to characterize a dynamical model and to look for chaotic behavior. Computation of the Lyapunov Exponents of a models is well known, and there are also many articles referred to its estimation in the case of time series. But it has not been resolved yet the problem of the estimation error inherent to any calculation with real data. This estimation error plays a key role in testing the hypothesis of positive exponents, as a signal of chaos in the time series, mainly working with short time series, noisy time series, or low positive values for the exponents.

Some works has appeared in recent years that tried to give an answer to this problem. Some of them are parametric, and some are non-parametric. In the present paper we compare the results of using these methods with short, noisy time series obtained from the Spanish Economy.

Jeffrey Goldstein, Adelphi University,
goldstei@adelphi.edu
Robin Robertson, *ro29nr@pacbell.net,*
www.RobinRobertson.net
William Sulis, McMaster University,
sulisw@mcmaster.ca
Sat 9:00-10:30 Session, Room 208
Chaos, Complexity, and Metaphysics
Einstein once asserted in an article (co-written with Leopold Infeld), "The results of scientific research very often force a change in the philosophical view of problems which extend far beyond the restricted domain of science itself. Schopenhauer had voiced a similar point concerning scientific findings, "...the corrected, extended, and more thorough knowledge of nature is the very knowledge that always undermines and finally overthrows the metaphysical assumptions that until then have prevailed."

Indeed, the varied fields constituting the sciences of complex systems have been touching many of the most salient philosophical issues of the last century including such formidable subjects as the origin and nature of life, theories of consciousness, the soundness of reductionist explanations, the need to update traditional views of causality and determinism, the course of evolution, implications of thermodynamics and statistical mechanics, the relation of parts to wholes, and other equally thorny matters. Simply concentrating on the empirical findings themselves would forfeit the conceptual opportunities offered by them.

In this symposium we would like to present several metaphysical implications drawn from the study of complex systems. The format will be a cross between individual presentations and a panel discussion. That is, one person will be presenting at a time but the other two panel members will chime in when appropriate.

In particular, we will discuss the following topics:

1. Archetypal dynamics and the nature of emergence. Presented by William Sulis, MD., Ph.D. "Archetype" is here being used in a sense influenced by but also different from that of Jung.

2. Emergence and self-transcending constructions. Presented by Jeffrey Goldstein, Ph.D. The construct of emergence will be discussed as a means of access into a wider, more basic metaphysical construct, that of self-transcending constructions which can be used to replace such earlier metaphysical notions as Whitehead's process.

3. The Case of the missing 3rd. Presented by Robin Robertson, Ph.D. How is it that form arises out of chaos? How do we reconcile mind with body? In attempting to deal with these primary questions, time and again a "missing third" is posited that lies between extremes. The problem of the "missing third" can be traced through nearly the entire history of thought. The form it takes, the problems that arise from it, the solutions suggested for resolving it, are each representative of an age. We will present several such watershed points.

Joel F. Gordon, MDRC, *joel.gordon@mdrc.org*
Sat 14:00-15:30 Session, Room 224
Using Developmental Trajectories to Explore "Bios"

In recent papers Sabelli and his colleagues have suggested that a variant of chaos they call "bios" is useful for thinking about creativity. To model this behavior they invoke a process equation, $x' = x + g * \sin(x)$, where increasing the parameter g ("gain") beyond a threshold drives trajectories into a quasi-random, not quite chaotic pattern "bios". This investigation employs a developmental approach in which the "gain" parameter in these equations is increased with each iteration. An easily implemented spreadsheet model is used to demonstrate assorted types of "biotic" trajectories. Results indicate that there may be scattered regions where these trajectories reveal novel characteristics, reinforcing the proposal that there are ways in which bios can be seen as distinct from chaos. In addition, this report will explore ways in which replacing the 'sin(x)' term of the process equation with a Fourier expansion can result in an enhanced range of behaviors within biotic systems. The discussion will address how looking at trajectories developmentally reveals characteristics of systems that are not apparent from standard bifurcation diagrams and also consider the unexpected stability found at high settings of the gain parameter. I will conclude with speculations on using the bios concept metaphorically in thinking about change and creativity.

Stephen J. Guastello, Department of Psychology,
Marquette University,
stephen.guastello@marquette.edu,
www.marquette.edu/psyc/guastell.html
Sun 16:00-17:00 Session, Room 224
WORKSHOP: Accident Analysis and Prevention

The goal of this extended workshop presentation is to make the bridge between conventional thinking on this topic and what has been learned from studies in nonlinear dynamics and complex systems. Although much of the system-related knowledge has been gained from occupational accident situations, the principles generalize well to accident situations in transportation, health care, and public situations.

The program will begin by considering several concepts of causation that permeate the risk analysis literature: the single cause and risk ratio, chains of events, fault tree analysis, factorial models, and catastrophe models. Basic ergonomics and stress variables can be important contributors to any of the foregoing causal structures. Fault trees, which have become known as dynamic fault trees in recent years have the capacity to track complex events as they unfold over time. Catastrophe models, which are clearly nonlinear and dynamic, describe and predict discontinuous changes of events over time.

The catastrophe models characterize single accidents as well as collective accident experience. Statistical properties of accidents and catastrophes will be addressed and will be of particular interest to participants with actuarial or other research objectives.

Frontier issues in accident analysis and prevention involve complex systems with multiple human and machine agents. How can task groups become coordinated or destabilized? What properties of human-machine interaction lead to stabilization? How is the concept of chaos relevant?

Prevention techniques range from those that are centered on the individual human agent to those that affect complex systems. Levels of effectiveness for some benchmark systems are considered along with emergency management systems.

Christine Hardy, Centre Eco-Mind,
101515.2411@compuserve.com, http://eco-mind.org
Sun 14:00-15:30 Session, Room 220
Intuitive Dynamics and Chaos

Semantic Fields Theory (Hardy, 1998), as a cognitive theory, allows us to formalize some of the dynamics of this stupendous human capacity, intuition, which comprises a variety of sophisticated non-logical thinking modes. According to SFT, the fundamental dynamics of a cognitive system is the Spontaneous Linkage Process. This connective dynamics is triggered between semantic constellations (or SeCos) by a common semantic feature (similarity of feeling, value, form or semiotics, that is, of a semantic content of any type), and may connect together different levels of the Mind-Body-Psyche system, or distinct SeCos. Using SFT's framework allows us to map sophisticated intuitive dynamics, such as Communication at a distance between the semantic

fields of two linked people; sensitivity to the state of distant systems the connective process may also connect consciousness semantic fields with eco-semantic fields in the environment or objects; sensitivity to the influence of internal SeCos as attractor-basins the SeCos, as attractor-basins are bending the probability of internal events and behaviors toward their attractors and thus inform possible future states, thoughts and events toward past trajectories; Foreknowledge of one's own transformation processes, that is, the premonition and precognition of future life companions and essential events; and finally, sensitivity to underlying thinking dynamics and logical fields the capacity to understand people through cultural and personal mental models or logfields.

Sandra Hayes, Department of Mathematics, Technical University of Munich, Germany, *hayes@mathematik.tu-muenchen.de*
Sat 11:00-12:30 Session, Room 220
Chance and Deterministic Chaos
The notions of chance and deterministic chaos, which seem contradictory , are intricately related. This talk will investigate an aspect of this fascinating relationship which has hardly been considered at all, namely to classify nonlinear deterministically chaotic dynamical systems as stochastic time series models, even as possible linear models.

Although the orbits of a chaotic dynamical system f are obviously purely deterministic, being governed by f, they can be understood from a statistical perspective. Until now, ergodic theory has been the standard tool used to study typical orbit behavior from a measure theoretical standpoint. A different approach is from the viewpoint of time series analysis.

The only result to date in this direction involves the asymmetric tent map, a classical example of a nonlinear chaotic system, which was shown to have the same autocorrelation function as a linear stochastic autoregressive process of the first order with uniform marginal distribution (Sakai and Tokumaru, 1980). This surprising fact explains in a precise manner why the orbits of the tent map look random: the deterministic dependency on the past decreases exponentially in time and the influence of white noise dominates.

Time series models for other chaotic dynamical systems will be presented and classified as standard time series models. Understanding the relationship between random and chaotic time series is of paramount importance in all applied fields, since all experiments produce time series.

Tom Hollenstein, Department of Human Development and Applied Psychology, University of Toronto, *thollenstein@oise.utoronto.ca*
Sat 14:00-15:30 Session, Room 224
Variability as a Variable: A Model and Measure of Behavioral Flexibility
Flexibility of responses to changes in the environment is a key component of adaptive behavior. In psychology, however, behavioral flexibility has received only brief attention at the theoretical level and has not been adequately defined, modeled, or measured. This presentation defines flexibility using a dynamic systems model of three nested time scales. This model defines flexibility as the moment-to-moment variability among discrete psychological states. This real-time variability at a micro scale is differentiated from variability at a meso time scale, which is the relative stability of the system. It is at this meso-scale that we can identify attractors as the recurring patterns that emerge from micro-scale variability. The third scale, or macro scale, is the developmental time scale in which the relative continuity of these attractors can be observed. The flexibility of parent-child interactions is used as an illustration of how the micro scale in this model can be measured and analyzed. This study tested the hypothesis that low flexibility in parent-child interactions is related to problem behaviors emerging in early childhood. Measures derived from state space grids (plots of the real-time trajectories of the dyadic interaction) are used to show that diminished flexibility (i.e. rigidity) is related to growth in antisocial behavior and internalizing problems in 5-6 year olds. Implications of these measures of flexibility are discussed in relation to the other two time scales in the model.

John Howie, Department of Psychology, Pikeville College, *jhowie@pc.edu*
Carol Grizzard, Department of Religion, Pikeville College, *grizzard@pc.edu*
Darrell Riffe, Pikeville College, *driffe00@pc.edu*
Sat 18:15 Poster Session, Outside Rooms 426-430
Creating Chaos from the Void in Mesoamerica
Many cosmogonic myths begin with a primordial unity-the void, the monad, primal chaos-that then bifurcates into a masculine and feminine pole. The feminine aspect is often then raped, flayed, torn asunder, or dismembered to create the discrete particulars of the material world while the masculine component remains spiritual, universal and heavenly. For some cultures there is a second bifurcation point, either a twinning into a better and a worse of the same gender or a reiteration of the original contrasexual bipolarity with self-similar results. Does masculine dominance necessarily require feminine dismemberment? Does such a myth of origins entail an apocalyptic ending and return to the formless beginning? We explore these issues in the context of ancient Mesoamerican civilizations, with particular emphasis upon the Aztec cosmology as symbolized by the colossal statue of Coatlicue, the decapitated ancient mother goddess of the serpent skirt. The ritual space she inhabits at El Templo Mayor, where thousands upon thousands of human sacrifices were ritually performed, reiterates the origins of the universe as well as that of the Mexica society. For those of us who are seeking a new mythological paradigm for the twenty-first century, it behooves us to carefully examine through the lens of chaos theory what not to do.

John Howie, Department of Psychology, Pikeville College, *jhowie@pc.edu*
Ben Goertzel, *ben@goertzel.org*
Sat 14:00-15:30 Session, Room 220
Computational Analysis of Dream Motifs
Dream texts are notoriously nonsensical. One method for discovering their implicit order is first to identify a motif, then to seek out its recurrence in subsequent dreams, and finally to analyze the entire series for the symbolic significance of the motif. The changing manifestations of the dream motif thus form a trajectory which reflects the higher-dimensional

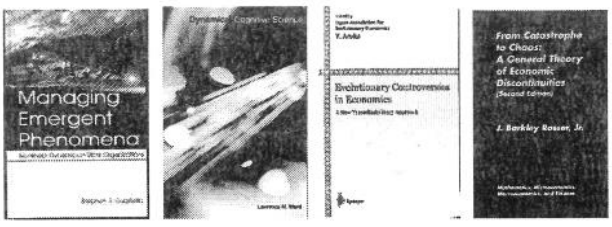
trajectory followed by the dreaming mind as it changes through time.

Is it possible for a computer program to assist in locating, collecting, and analyzing recurrent dream motifs? Can computational analysis facilitate the process of deriving a conscious meaning from the largely unconscious dream text? Can dynamical systems theory elucidate the trajectories of dreams and the dreaming mind? We have designed a software analytical process for the computational analysis of dream texts and applied a simple prototype version to a collection of several hundred dreams recorded by a single dreamer over a period of years. Although our initial prototype is based on word frequency statistics rather than more advanced natural language processing, nevertheless it has the ability to enhance the exploration of dream motifs beyond what can be done purely "by hand."

David Katerndahl, Department of Family and Community Medicine, University of Texas Health Science Center at San Antonio, *katerndahl@uthscsa.edu*
Sun 11:30-12:30 Session, Room 224

Why Family Physicians Provide a Lower Quality of Care Compared to Cardiologists and Psychiatrists

Comparison studies suggest that the quality of care provided for specific medical conditions is poorer in primary care than in specialty settings. Purpose: To estimate the complexity of ambulatory patient encounters in family practice, cardiology, and psychiatry settings. Methods: Secondary analysis of the 2000 National Ambulatory Medical Care Survey (NAMCS) data using ambulatory patients seen in family practice, cardiology, and psychiatry settings. The measures used described the quantity of information and services exchanged between patient and, the visit-to-visit variability of these exchanges, and their overall diversity. The complexity for each variable was estimated as the quantity weighted by variability and diversity. Input and output as well as total encounter complexity were estimated. Results: Although there was minimal difference in the unadjusted complexity of encounter input of family practice and cardiology, psychiatry's input is less. Cardiology involves more input quantitatively, but the diversity of family practice input eliminates the difference. Cardiology also involves more complex. Overall, there is little difference in the unadjusted complexity of encounters in family practice and cardiology. However, when the duration of visit is factored in, the care provided in family practice becomes twice as complex relative to cardiology and seven times as complex relative to psychiatry. Conclusions: The poorer quality of care reported in studies of family practice relative to cardiology and psychiatry may reflect the increased complexity of the encounters. In addition to the use of case-mix, estimation of input and output complexity may be another tool for adjustment in policy-relevant studies.



Peter Knapp, Department of Sociology, Villanova University, *peter.knapp@villanova.edu*
Lance Hannon, Department of Sociology, Villanova University, *lance.hannon@villanova.edu*
Sun 9:30-11:00 Session, Room 220

Nonlinear Effects of Concentrated Poverty on Homicide Rates: Effects and Alternatives to Log-transformation

A considerable body of theory and research has suggested that concentrated poverty has accelerating effects on homicide rates, and other rates of violent crime. In sociology and criminology, these nonlinear effects are important in explaining the collapse of structures of social opportunities or social controls, and they also help explain the nonlinear interactions of other variables related to the crime rates, such as racial composition or rates homeownership. Similarly, in developmental psychology, nonlinear effects of stress, trauma and disadvantage illuminate central puzzles about discontinuities of development and processes of collapse or resilience. The findings of accelerating effects have been partly contradicted by research finding decelerating effects of concentrated poverty on homicide rates that has suggested contrasting models of the effects of concentrated community disadvantage. Part of the inconsistency of existing studies results from use of log transformation of skewed dependent variables. We resolve part of the inconsistencies in the existing findings and examine further methods of analysis, including inverse transformation and analyess using heteroscedasticity consistent standard errors. We also discuss some of the outstanding theoretical problems concerning these nonlinear effects.

Matthijs Koopmans, Metis Associates, *mkoopmans@verizon.net*
Sat 18:15 Poster Session, Outside Rooms 426-430

Do Mental Illnesses Run in the Family? Two Perspectives on the Role of Family Interaction in the Onset and Course of Schizophrenia

There are two ways in which research about schizophrenia has concerned itself with family interaction. One research tradition evolved out of the work of family process theories (e.g., Bateson, Lidz, Wynne, n-bind theory), which argue that certain types of dysfunctional family interaction occur more often in families who have a schizophrenic member than in other families. In spite of their considerable influence on clinical practice, there is little empirical evidence up to this point to support these models. A second strand of research has studied characteristics of family interaction to predict relapse among former schizophrenic patients who return to their families (Vaughn, Leff, and many others). The finding that certain family interaction features (e.g., emotional overinvolvement) are indeed good predictors of relapse, has been successfully replicated many times. This research has shied away, however, from the question what predicts the first onset of the disorder.

This presentation will examine the compatibility of these two perspectives and argue that important similarities between the two approaches about what occurs in the families of schizophrenic individuals are obfuscated by differences in vocabulary and by the fact that one focuses on the origins of the disorder and the other on its maintenance over time. It will

be assessed to what extent the findings about relapse can be used to more effectively address etiological family process questions, and whether insights from family process theory can be used to provide greater specificity to the theories concerned with the prediction of relapse.

Matthijs Koopmans, Metis Associates,
mkoopmans@verizon.net
Sun 11:30-12:30 Session, Room 224
What Are the Causes of Schizophrenia? The Challenges to Family Process Theory and Research

Two factors have hampered attempts to empirically establish whether or not dysfunctional family interaction is an etiological factor in the onset of schizophrenia. First, there has been growing modesty among researchers about our ability to demonstrate such relationships empirically. Moreover, most thinking about the cause of schizophrenia takes place within the vulnerability-stress paradigm, which postulates that a constitutional vulnerability to the disorder is a necessary condition for its occurrence, and that stress from the environment may provoke symptoms in individuals who are constitutionally vulnerable. Models deemed incompatible with this general paradigm, such as dynamically oriented family process models, have been largely abandoned, under the mistaken understanding that those models are necessarily purely environmental.

One of the challenges to family process research is therefore to determine its compatibility with the traditional vulnerability-stress paradigm, and assess whether modifications are required to that paradigm to accommodate hypotheses derived from family process theory. This presentation will argue that while family process models are not necessarily incompatible with the vulnerability-stress paradigm as it is, its specific proposals about what exactly individuals are vulnerable to and about how stress operates to provoke symptoms, diverge from how the vulnerability-stress paradigm is traditionally understood.

Martin B. Kormanik, O.D. Systems, Inc.,
mkormanik@odsystems.com,
www.odsystems.com#http://www.odsystems.com
Sat 11:00-12:30 Session, Room 224
The Complexity of Workplace Violence: Diagnosing Organizational Awareness

Strategies for addressing workplace violence are generally proactive, focused on prevention and preparation, or reactive, focused on response to an incident. Before strategies are put in place, however, the complexity of the issue demands an organizational diagnosis so that chosen strategies have maximum benefit. Awareness development is a construct for analyzing cognitive and psychosocial growth in relation to a transitional issue and planning interventions that support growth in relation to the transitional issue. This study shows that using the awareness development construct to examine individual employees' growth regarding the transitional issue of workplace violence may serve as a practical measure for organizational diagnosis; assessing the as-is condition amidst the chaos and planning appropriate intervention strategies. Implications for theory and research are discussed.

W. F. Lawless, Paine College,
lawlessw@mail.paine.edu
Sat 9:00-10:30 Session, Room 220
A Non-linear Quantum Model of Organizations, Decision-making and Brain Waves

The major unsolved problem in social interaction theory is the rational ability to distinguish an aggregation of individuals from a group (Levine & Moreland, 1998), primarily from theory derived from individual perspectives (Luce & Raiffa, 1967). In contrast, the social quantum model (SQM; from Bohr) has made progress with a non-linear mathematical model of the conjugate factors of action and observation uncertainty for entangled agents (Lawless et al., 2000). We have made two extensions, to organization (Lawless & Chandrasekara, 2002) and argument theory (Lawless & Schwartz, 2002). First, organizations grow when recruits reduce their combined energy, E, into a joint ground state; bonding increases between recruits and a leader as vocal frequencies converge (resonance; or inversely, reactance); interaction success depends on its cross-section; and the likelihood of an interaction varies inversely with the E it requires (respectively, a well-trained recruit; close relationships; movie-line queues; popular restaurants). Second, quantum-like square E wells associate mathematically with emotion and decision-making (e.g., the optimum solutions of ill-defined problems occur when incommensurable beliefs interacting before neutral decision makers generate sufficient emotion to process information, I, but insufficient to impair the interaction; in Lawless, 2001). We speculate that interaction cross-sections are related to brain waves: if gamma waves ($\approx$ 40 Hz) bind sensory features into mental objects (Engel et al., 1999) and concepts (Lawless & Chandrasekara, 2002), transitions between opposing views in an argument reflect the time to apply difficult concepts to problems, linking solution "detection" to signal detection theory (e.g., Luce, 1997). Thanks to J.A. Ballas ITD, NRL, Washington, DC, where most of this research was conducted with funds from ONR through an ASEE grant.

Engel, A. et al. (1999). Consciousness and Cognition, 8(2), 128-151.
Lawless, W.F. (2001), 73-78, Proc. AAAI Fall.
Lawless, W.F. et al. (2000), in Tessier et al., Conflicting agents, 279-302, Kluwer.
Lawless, W.F. & Castelao, T. (2001), IEEE Techn. Soc., 20(2), 6-17.
Lawless, W. F., & Chandrasekara, R. (2002). Proc. AAAI Fall, pp. 26-31.
Lawless, W. F., & Schwartz, M. (2002). Social Science Computer Review (Sage) 20(4), 441-450.
Levine, J.M. & Moreland, R.L. (1998), Small groups, In Gilbert et al., Hdbk Soc Psych, 415-469, McGraw.
Luce, R. D., & Raiffa, H. (1967). Wiley.
Luce, R. D. (1997). J Math Psychology 41: 79-87.

Ivelisse Lazzarini, School of Allied Health Professions, University of Saint Louis, *ilazz@earthlink.net*
Sat 18:15 Poster Session, Outside Rooms 426-430
Nonlinear Dynamics of Occupation: A Case in Point

In this presentation we will discuss a case study from the perspective of nonlinear dynamics as it pertains to the practice of occupational therapy in an acute care psychiatric setting.

Through a conceptual framework of brain dynamics, treatment interventions will be described and explained to elucidate the complexity of self-organized systems.

Marc D. Lewis, Program in Developmental Science, University of Toronto, *mlewis@oise.utoronto.ca,* http://home.oise.utoronto.ca/~mlewis/
Jim Stieben, Program in Developmental Science, University of Toronto, *jstieben@yorku.ca*
Sun 11:30-12:30 Session, Room 208
Emergent Emotional Appraisals: Theory and Data from Psychology and Neuroscience
One of the principal aims of emotion theory is to model the relations between appraisals (cognitive or perceptual evaluations) and the emotions with which they correspond. However, the cognitivist approach portrays appraisals as causal antecedents of emotions in a oneway progression--ignoring the possibility of reciprocal and multiple causation. For several years the first author has been modeling appraisal-emotion relations as self-organizing gestalts emerging out of reciprocal and recursive interactions among cognitive, perceptual, and motivational constituents. However, this work has remained abstract and lacking in precision.

In this paper, we show how many of the basic assumptions of functional neurobiology support a view of emotional appraisal as self-organizing in real time, and these assumptions can help move us toward a more detailed model. Panksepp, Tucker, Freeman and others view emotion-cognition states as spontaneous synchronization between cortical and subcortical systems. We model attention-emotion synchronization as "vertical integration" across levels of the neural hierarchy. Motivational agendas mediated by lower structures entrain cortical processes of perception and cognition, while these in turn regulate and constrain more primitive motivational activities. Hypothetically, feedback among interconnected systems at each of these levels allows the entire brain to converge to an attractor rapidly in real time, while neuromodulator release and synaptic adjustments help maintain this attractor and strengthen it across occasions.

To begin to flesh out these ideas with current EEG/ERP methods, we demonstrate the existence of brief epochs of frontal-cortical coherence at the theta frequency associated with limbic activation. 128-channel data analyzed with a new source localization package will be presented. Bouts of coherence can be seen when subjects become aware that they have made an error, suggesting an emerging appraisal of vigilant concern potentially linked with anxiety.

Larry Liebovitch, , Center for Complex Systems and Brain Sciences, Center for Molecular Biology and Biotechnology, Department of Psychology, Department of Biomedical Science, Florida Atlantic University
liebovitch@clifford.ccs.fau.edu,
http://www.ccs.fau.edu/~liebovitch/larry.html
Fri 13:30-17:30 Workshop, Room 220
Introduction To Fractals And Chaos
See Workshop Descriptions (*Newsletter, April 2003*).

Larry S. Liebovitch, Center for Complex Systems and Brain Sciences, Center for Molecular Biology and Biotechnology, Department of Psychology, Department of Biomedical Science, Florida Atlantic University
liebovitch@clifford.ccs.fau.edu,
http://www.ccs.fau.edu/~liebovitch/larry.html
Viktor K. Jirsa, Center for Complex Systems and Brain Sciences, Department of Physics, Florida Atlantic University, *jirsa@clifford.ccs.fau.edu,*
http://www.ccs.fau.edu/~jirsa/
Lina A. Shehadeh, Center for Complex Systems and Brain Sciences, Department of Physics, Florida Atlantic University, *shehadeh@clifford.ccs.fau.edu*
Sun 9:30-11:00 Session, Room 208
Determining the Network of Genetic Regulation from cDNA Microarrays
Genes form a complex network of interactions. Protein transcription factors from some genes bind to and regulate the expression of other genes. Until now, determining these networks of genetic regulation has required multiple experiments that correlate the expression of genes under different experimental conditions. We show that it is possible to determine some properties of the network of genetic regulation from the mRNA levels of a single experiment. The mRNA levels depend, in part, on the net interactions between all the genes. We show here that different networks of genetic regulation produce different statistics of mRNA levels, as measured by the number of genes PDF(x) expressing amounts of mRNA between x and x+dx. This makes it possible to determine some information about the network of genetic regulation from the statistics of mRNA levels measured in a single cDNA microarray experiment. These results may provide: 1) a new method to analyze the tremendous amount of data from cDNA microarray experiments, and 2) a screening assay to identify the systems or sub-systems of genes that will be most productive to study by the traditional methods and the best ones for therapeutic intervention.

Curt Lindberg, Plexus Institute,
Curt@PlexusInstitute.org, www.PlexusInstitute.org
Sun 9:30-11:00 Session, Room 224
Too Beautiful: A Story of Complexity, a Family and End-of-life Care
This is a story about how my family used concepts inspired by complexity science to inform how we worked to make the last days of my father comfortable, free of pain, and full with dignity, meaning, and love. Using such complexity ideas as self-organization, nonlinearity, information flow and feedback, diversity of agents, and simple rules, my brothers, sister and I created several organizing principles to guide our efforts.

They included: honor the guidance Mom and Dad had provided us; stay in touch and share lots of information; use the wisdom and diverse skills and insights in the family; take baby steps, see how they work and adjust quickly; and provide whatever stability and certainty we could. Together we helped our father experience a "good death", an experience full of little miracles. "I am leaving under the circumstances everyone wishes for," he told us as he passed away

Patricia A. Lipscomb, Clinical Professor, University of Washington School of Medicine, *hurdygurdygirl@molehaven.com*
Sun 14:00-15:30 Session, Room 220
Strange Bedfellows:
Frequently Confused Concepts in Interdisciplinary Writing on Nonlinear Dynamics
To paraphrase Shakespeare, nonlinear dynamics acquaints us with strange bedfellows, i.e., concepts pairs that so frequently appear hand-in-hand in interdisciplinary writing that nonmathematical readers may mistakenly infer that they are inseparable. Such pairs tend to take one of two forms. In one, the members of the pair are related but distinct concepts from nonlinear dynamics (e.g., fractal/self-similar and theoretical/real-life chaos). In the other form considered here, one member represents a concept from nonlinear dynamics but the other (sometimes a homograph of the first) is linked to it not by mathematical considerations but by verbal association or a plain-language reading (e.g., dynamic/dynamic and iteration/recurrence). The present discussion begins by addressing the central importance in mathematical communication of fine distinctions between related mathematical concepts (which entails a necessary distinction between the mathematical and vernacular meanings of most mathematical terms) and then distinguishes between the members of a number of such potentially confusing concept pairs. The goal is to offer nonmathematical readers a means of grasping these concepts more clearly and to encourage authors writing to a broad interdisciplinary readership to anticipate and avert misunderstanding of frequently confused concepts by making distinctions explicitly clear.

Yeou-Teh Liu, Department of Physical Education, Taiwan Normal University, *yeouteh@cc.ntnu.edu.tw*
Gottfried Mayer-Kress, Department of Kinesiology, The Pennsylvania State University, *gmk@santafe.edu,* http://www.personal.psu.edu/faculty/g/x/gxm21/
Karl M. Newell, Department of Kinesiology, The Pennsylvania State University, *kmn1@psu.edu*
Sat 18:15 Poster Session, Outside Rooms 426-430
Qualitative and Quantitative Change in Motor Learning
The experiment examined the qualitative and quantitative change in the dynamics of learning a novel motor skill (roller ball task) as a function of the manipulation of a control parameter (initial ball speed). The focus was on a dynamical systems analysis of the relation between the rates of change in performance over practice time and the changing time scales of the evolving attractor dynamic in wrist coordination space. The results showed 3 different learning patterns to the changes in the dynamics as a function of practice that were mediated by the initial ball speed. Only the participants that learned the task showed a bifurcation in coordination mode that was preceded by enhanced performance variability. We claim that the bifurcation is of rep saddle-node type which would also imply the testable prediction of hysteresis that will be tested in future experiments. The observed multiple time scales to motor learning are interpreted as the products of the dynamical stability and instability realized from: (1) the continually evolving landscape dynamics due to bifurcations between attractor organization; and (2) the transient phenomena associated with moving toward and away from fixed point dynamics.

Thomas E. Malloy, Department of Psychology, University of Utah, *malloy@csbs.utah.edu*
Carmen Bostic St. Clair, Quantum Leap, *ql@quantum-leap.com*
John Grinder, Quantum Leap, *ql@quantum-leap.com*
Sun 14:00-15:30 Session, Room 220
Steps Toward an Ecology of Emergence
In terms of Bateson's Ecology of Mind framework, and given that emergence is a human mental construct (which great promise of useful application to the world), we may ask into what sort of mental ecology of ideas might emergence fit? Most, if not all, examples of emergence are construed as hierarchies of levels (cell, tissue, organ). How does emergence fit other human constructs addressing the nature of hierarchies? Inheritability and constriction define Logical Hierarchies—"duck" inherits all the qualities of "bird;" moreover, "duck" is a more constricted set (that is, it has a smaller number of elements) than does "bird." In contrast, for Part-Whole hierarchies (say a ship composed of many parts) the parts do not necessarily inherit the qualities of the whole (a ship floats while a rivet sinks) and the set of parts is not necessarily a smaller, more constricted set than the whole (there may be many rivets in a single ship). Elements of sets and parts of wholes connote "thingness," whereas we will define emergence in terms of processes within complex dynamic systems. Parallel to Part-Whole hierarchies (a ship has properties that its parts do not have), Emergent Hierarchies will be defined in terms of coupled sub-processes whose interactions generate a higher-order process that has properties that do not exist within the lower level processes. This definition will be related to Goldstein's notion that emergence is characterized by radical novelty and confoundedness among levels and will be accompanied by examples from a dynamic systems simulation.

Thomas E. Malloy, Department of Psychology, University of Utah, *malloy@psych.utah.edu*
Gary C. Jensen, Department of Psychology, University of Utah, *jensen@psych.utah.edu*
Tim Song, School of Computing, University of Utah, *tim.song@csbs.utah.edu*
Sat 11:00-12:30 Session, Room 208
Perceiving Visual Pattern in a Dynamic Universe
How do humans perceive shape and extract pattern from a complex, dynamic universe? Aside from ecological optics, classical vision science theories tend to be based on static stimuli (e.g., line drawings, random shapes, 2- and 3-D computer graphics, photos). We will demonstrate how a simple dynamic systems simulation can generate visual stimulation that is dynamic not static and that has complex pattern structure. Assuming that perception routinely deals with such visual inputs, we propose a theoretical mechanism that capitalizes on dynamics by making apparent motion a key to pattern perception. Visual demonstrations will show clearly how human apparent motion perception can extract in real time the basin structure, sub-basin structure, and even static shapes and other features from a system that is nonlinearly dynamic. Apparent motion phenomena are typically

construed as illusions that have enabled the perception of movies and video. Perhaps they are more; surely the ability to perceive apparent motion did not evolve simply so we could watch movies and video. Rather, the ability to perceive apparent motion just might allow an organism to extract stable pattern from dynamic systems. This last point represents a departure from previous vision science approaches and offers a new theoretical toehold in shape perception.

Terry Marks-Tarlow, Clinical Psychologist, Private Practice, *markstarlow@hotmail.com*
Stephen Oyer-Owens, Humanities Concentration, University of Phoenix, *soyerowens@aol.com*
Dick Bird, Division of Psychology, Northumbria University, *dick.bird@unn.ac.uk,*
http://psychology.unn.ac.uk/dick/
Sun 14:00-15:30 Session, Room 208

The Experience of Hyperdimensionality

The hyperdimensional experience (HDE) may be defined as a psychological awareness of a dimension beyond that experienced previously, or normally and in everyday life. Sometimes the HDE is unexpected or fleeting, the result of a drug, temporary circumstances or a physiological state e.g. illness. Sometimes it is sought as an abiding frame of mind by means of a program of training, religious discipline or meditation, or as a successful outcome of psychotherapy.

By its nature the experience of hyperdimensionality means the sense of a further or higher dimension in perception, thought and feeling. As such it may be distinguished from other altered states of consciousness (ASCs), which may be positive, negative or even pathological in their effect. As distinct from ASCs in general, the HDE is felt as a liberating, expansive or life-changing experience. Often it is linked with intellectual and/or emotional insights, which again may either be evanescent or may be capable of subsequent articulation and elaboration in a productive sense.
In this symposium three speakers of very different outlooks and cultural backgrounds give their views on the significance of the HDE at a personal, societal and theoretical level. Personally, there is a need for transcendence of and liberation from the alienation of modern civilization. Societally, we need a mode of conflict resolution for some of the most intractable problems facing the world in the 21st Century. Theoretically, a psychophysiological explanation of HDEs is required. The idea is explored that the understanding and cultivation of HDEs as a normal part of society may be a vital factor in the future personal social and religious evolution of humankind.

PAPER 1: *Experiencing in Hyper-dimensions: Model for a New World Paradigm* **Stephen Oyer-Owens.** This paper proposes that we stand at the threshold of a new world paradigm for contemporary Western culture. The paradigm arises from our potential ability to experience in hyper-dimensions. Such a perspective can enable us to address fundamental societal and personal challenges in a new way, lay the groundwork for a new synthesis of the sciences, and provide new understanding of the nature of mysticism and its relationship to the sciences and daily life.

I will relate my own encounters with hyper-dimensional experience as it has arisen from my involvement in Lakota (Sioux Indian) ritual. My involvement has been based on several years' participation in the ceremonies of the Sweat Lodge, the Sun Dance, and Crying for a Vision. These experiences have resulted in multiple visionary encounters and a radical sense of unity between self and reality that is hyper-dimensional in structure.

This kind of hyper-dimensionality has been experienced by mystics and shamans for perhaps thousands of years, and may constitute the core transformation of self and being proposed by many of the world's great spiritual traditions. Such hyper-dimensionality is characterized by the marriage of contradictions in concepts, emotions, and other phenomena which seem impossible to reconcile in the linear thinking of daily life. This hyper-dimensionality also makes possible an intimate marriage between self and other. The resulting unities arise in a "place" which is "in between" the disparates, providing a hyper-dimension previously invisible to perception. The new perspective can be represented in a hyper-dimensional loop, bearing similarities to chaos theory and the geometry of fractals. In turn, the marriage of all such unities in hyper-dimensional loops can be depicted as a Nexus Point, a powerful and holographic-like center which enfolds the whole of creation.

Experiencing in hyper-dimensions can make possible new solutions to diverse conundrums such as the continuing occurrence of warfare in human cultures and the degradation of our planet's environment. It can provide new pathways for individual psychological growth and lay the groundwork for a hyper-dimensional psychology, based on a dynamic encounter with wholeness. These explorations can also lead to a new understanding of our relationship with the universe, providing new meaning to the nature of human life.

PAPER 2: *The Hyperdimensional Experience of Psychotherapy.* **Terry Marks-Tarlow.** When psychotherapy proves most successful, the hyperdimensional experience (HDE) occurs as the desired outcome of longterm, depth work. Here patients gain the capacity to sink beneath everyday surface events to the very origins of their consciousness. In this zone of expanded awareness, the external events of life are seen as meeting and fitting the internal contours of psyche like hand and glove. This eliminates all clear distinctions between inside/outside, self/other, mind/matter, and grants a wholeness to experience, a sense of "rightness" about how character and destiny intersect, even when this fit appears perfectly horrific. This paper links HDEs theoretically with Spencer-Brown's calculus of first distinctions. A state of "primordial confusion" is proposed to lie at the base of consciousness that can be modeled via re-entry dynamics by fractal boundaries between psyche and world. Within this paradoxical state, boundaries are simultaneously opened and closed, and opposites are equated.

This is the stuff either of madness or of higher consciousness, depending upon the strength of the therapeutic container along with the patients observing ego.

PAPER 3: *A Theoretical Basis For the Experience of Hyperdimensionality* **Dick Bird.** The experience of hyper-dimensionality (the Hyperdimensional Experience or HDE, otherwise known as the Oceanic experience, the Numinous, Unity of Opposites etc.) has specific condition of induction. occurrence, predisposition, and very specific consequences for the world view of the experiencer. Those who undergo HDEs typically emerge from them transformed in a variety of ways,

personally, philosophically and morally. Like the Square in E A Abbott's "romance of many dimensions" Flatland, we return to our everyday world with a new vision of something which lies beyond.

Here I discuss the possible basis for this experience of a higher dimension in terms of the processes of iteration and recursion. In our everyday lives we iterate, performing the same or slightly modified operations, but not perceiving them as located in time. When we enter a recursive viewpoint (the experience of the hyperdimensional) we can newly see the whole of our life and the lives of others from the outside as located in time. We also have an enhanced potential for the reconciliation of opposing viewpoints as aspects of a unified whole. This expanded perception typically remains even in the absence of the HDE itself.

A descriptive mathematical basis of HDEs is offered in terms of iteration theory and the Boolean arithmetic of Spencer-Brown and a possible basis in brain function for the HDE is suggested in terms of the self-monitoring of the refresh-rate of thalamo-cortical loops, possibly sustained by quantum-collapse events. The ontological viewpoint most compatible with this data is a monist idealism and the consequences of this are explored.

Terry Marks-Tarlow, Clinical Psychologist, Private Practice, *markstarlow@hotmail.com*
Sun 16:00-17:00 Session, Room 208
Slouching Towards a New Paradigm
SCTPLS has been in existence for thirteen years. With the butterfly effect the central metaphor of the new sciences, most of us expected a broad sea change to rapidly propagate through the field of psychology. Yet this has failed to happen. This paper addresses the social politics of why this may be the case and how we can address the problem.

Gottfried Mayer-Kress, Department of Kinesiology, Penn State University, *gxm21@psu.edu,*
http://www.personal.psu.edu/faculty/g/x/gxm21/
Holly Arrow, Psychology & Institute for Cognitive and Decision Sciences, University of Oregon
harrow@darkwing.uoregon.edu,
http://darkwing.uoregon.edu/~harrow/
Sun 9:30-11:00 Session, Room 224
Time-Scales of Virtual and Real Conferences as Binding Events in a Global Brain
The history of conferences is probably at least as long as that of modern civilizations and they certainly played an essential role in their evolution. In spite of thousands of years of technological progress very little has changed in the actual procedure and format: Participants gather at a common physical locations and listen to each others' aural presentations, sometimes accompanied by more or less illustrative visuals or demos.

The advent of telecommunications and the Internet triggered the emergence of conferences that take place in virtual spaces but their success has been limited mainly due to the lack of direct face-to-face interactions. Here we discuss some issues related to time-scales and how they interact with the number of participants. We claim that efficient integration of virtual and traditional conferences will be essential in a continued role of conferences as cultural "binding events" in what has become to be known as "Global Brain". These are seen in analogy of cognitive binding events in biological brains that are essential for feature integration. We present data from conference web-casts hosted by Complexity Digest, a weekly electronic newsletter that also web-casts conference presentations and summaries. Preliminary results suggest that typical time-scales of conference web-casts are of the order of one week compared to a few hundred milliseconds of human brains.

Mary Ann Metzger, Psychology Department, UMBC (Emerita), *metzger@umbc.edu,*
http://www.research.umbc.edu/~metzger/
Dick Bird, Division of Psychology, Northumbria University, *dick.bird@unn.ac.uk,*
http://psychology.unn.ac.uk/dick/
Fri 8:30-12:30 Workshop, Room 220
Drawing Conclusions From Time Series
See Workshop Descriptions (*Newsletter, April 2003*).

Daniel W. Miller, Consciousness Studies, Greenwich University, *danielwmiller@earthlink.net,*
www.danielwmiller.net
Sat 11:00-12:30 Session, Room 224
The Web and the Cloth: Science, Consciousness and Homeodynamics - What They Are and What They Do
The systems model for homeodynamics is drawn from the work of Bertalanffy, Kauffman and Capra, among others who have argued in favor of Systems, Chaos and Complexity theories. Homeodynamics is the driving force behind psychological and physical systemic interactions that serves to optimize relationships for the sake of each system's survival. It enters into the realm of the sciences through astronomy, physics, biology and evolution, and into phenomenology and psychology through psychotherapy and neuropsychology. Conflicted scientific and phenomenological research can be bridged when we understand that the operation of consciousness takes its many diverse forms because it is used as a tool of research that formulates observations appropriate to the needs of each field of investigation.

In the life sciences, Homeodynamics, implementing its survival mandate through the agency of consciousness, provides a common baseline for the unification of mind and body. This has important consequences for the perception and treatment of mental and physical illness, for which a Range of Homeodynamic Efficiency (RHE) is formulated. This range is applied to the activity of consciousness in integrating the mind-body relationship such that mental and physical health can be evaluated on a continuum of stress and optimal homeodynamic functioning. This systematization effectively defragments the piecemeal categorizations within mental and physical illness. Society and the ecology can also be evaluated in terms of implications derived from the homeodynamic process.

Susan Mirow, University of Utah School of Medicine, *susanmirow@aol.com,*
Robert J. Porter, Directions for Mental Health, Clearwater, Florida, *rjporter@mindspring.com,*
www.mindspring.com/~rjporter

Sat 14:00-15:30 Session, Room 224

Psychophysiological Measures of Variability in Heart-Rate and Activity in At- Risk Youth After Psychomotor Treatment

At-risk youth who engage in violent and antisocial behaviors can show either an over-reactive or an under-reactive physiological pattern in response to stress. Those youth who have histories of childhood neglect tend to be the under-reactive ("predators"), while those youth who have childhood histories of abuse ("posttraumatic stress") tend to be over-reactive. We reasoned that these patterns might be seen in a sample of at-risk youth and that changes in physiological parameters might be observed following interventions designed to address the sequelae of neglect and abuse, i.e., difficulties with affect regulation and arousal. We present the results of a project investigating this hypothesis in a group of incarcerated male youth, ages 15 to 19. Subjects wore portable heart-rate (Rozzin ® Holter monitor) and activity measuring devices (actigraph: Motionlogger ®) for 24-hour periods before and after a six-week treatment program of specially-designed, group therapy addressing psychomotor reactivity and affect regulation. In addition, both line-staff and subjects completed pre-printed computer forms rating subject's behaviors and mood variables. Data analysis techniques were designed to reveal nonlinear dynamical processes involved in the psychophysiological mechanisms regulating affect and arousal. We present an overview of psychomotor group treatment as well as the results for the first group of six youth who competed the project. (Research supported, in part, by Copperton Place and the Cumming Foundation.)

Olga Mitina, Department of Psychology, Moscow State University, *omitina@yahoo.com*

Sun 14:00-15:30 Session, Room 224

Using Structural Equation Modeling for Nonlinear Dynamic System Theory

Structural Equation Modeling (SEM) is a collection of statistical techniques that allow to examinations between variables in social science and psychology. But as usual researchers use these techniques for usual statistics model (linear, one-to-one correspondence and so on). Meantime SEM could be very useful for analyzing data coming from nonlinear dynamic system models. For example SEM allows to analyze time-series process, nonlinear regression models, multilevel models. Applications of SEM are very adequate in social science, when we can't perform a lot of measurements what we really need to use traditional NDS methods which come from the physics, biology and so on. Usually researchers use SEM for linear analysis and just ignore "nonlinear" options. In the paper we are going to present some relevant to NDS SEM methods and ideas and also to demonstrate some examples.

Kathleen Moffett-Durrett, Kent School of Social Work, University of Louisville, *kathleenmoffett@aol.com*

Sat 18:15 Poster Session, Outside Rooms 426-430

The Introduction of a Systems Perspective to Child Welfare Workers: A Preliminary View

Kentucky has moved from traditional services perspectives to considerations which include analyzing client systems and using client directed team work aimed towards resolution of problems resulting in child maltreatment. Direct service workers are being asked to make a radical change in perspective which involves being able to form judgments utilizing a "systems lens." My work involves looking at language and behavior changes among workers for indicators that new perspectives are being assimilated into their practice.

Shapour Mohammadi, Economics, University of Tehran, *Shapoor22@hotmail.com*
Hossein AbbasiNejad, Econometrics, University of Tehran, *habasi@ut.ac.ir*

Sat 18:15 Poster Session, Outside Rooms 426-430

Application of Factor Analysis in Catastrophe Theory

We report results of one-year study of the role of the factor and the cluster analysis in selection of proper proxy for control variables in catastrophe models. Application of factor rotation in construction and interpretation of control variables, is of our main interests too. Our study suggest that this method can be helpful in finding the minimum change of socioeconomic variables for a jumping taking place in the related system. Unobservable control variables can be extracted using cluster and factor analysis. The practical considerations will be done in the analysis of macroeconomic time series of Iran economy.

Jo Alyson Parker, Department of English, Saint Joseph's University, *jparker@sju.edu,*
http://www.sju.edu/~jparker/

Sat 14:00-15:30 Session, Room 220

Narrating the Workings of Memory: Iteration, the Iterative, and the Paradox of Proust's "Temps Perdu"

This paper comes out of a larger study wherein I explore how the insights provided us by chaos science enable us to look anew at narrative structuration and meaning, especially with regard to temporally "chaotic" texts. Here I explore Marcel Proust's achievement of what I call "bounded randomness" through his use of the iterative mode of narrative frequency. Drawing on Paul Ricoeur's description of the "dynamic of emplotment," I argue for the appropriateness of the analogy between narrative structuration and the complex systems investigated by dynamicists. I then discuss the analogy between iteration and the iterative, a predominant mode in Swann's Way. Because of computer simulation, dynamicists have been able to perform the innumerable mathematical iterations that allowed them to discern deterministic chaos-to see a global pattern, such as the strange attractor, emerging from local randomness. Similarly, the iterative mode involves synthesizing related events-in effect, creating a global pattern from the various local random fluctuations that occur. Turning to Swann's Way, I argue that Proust gives us only the emergent structure of the narrator's childhood daily walks-walks that are globally determined but subject to local randomness. Out of the iterations of many daily walks, an emergent structure takes shape, and the narrator's synthesizing memory can thereby evoke the reality of a time once lost. By examining Proust's iterative through the lens of chaos science, we can better apprehend his insights about how the random events of our lives achieve meaning through the synthesizing power of memory.

Annemarie Peltzer-Karpf, Department of Language Development, Graz University,
annemarie.peltzer@kfunigraz.ac.at
Manuela Wagner, Dept. of Language Development, Graz University; Harvard Graduate School of Education,
wagnerma@gse.harvard.edu
Sat 18:15 Poster Session, Outside Rooms 426-430

The Chaotic Itinerary to the First Language in Ordinary and Exceptional Circumstances

This paper features temporal asynchrony in system development. In order to come to terms with protracted phase-shifts and retarded development a model developed for the dynamic assessment in normal children is adapted to the special exigencies of children with sensory, cognitive and linguistic problems (range 1;6 - 3;1). The non-linear approach proposed unites developmental cognitive neuroscience and dynamic systems theory. We start from the assumption that maturational factors and experience play complementary roles in forming specialized systems which display different degrees of experience-dependent modification and operate at different time scales. The chaotic itinerary to language reads as follows: (1) the initial pseudo-stable state exhibits a transition from holistic to gradual analytic decoding; linguistic behaviour is dominated by the search for coherence expressed in memorized (non-analysed) chunks and restricted variation, (2) the intermediate stages are characterized by the extraction of rules alongside with the (re-) modelling of neural connections, the reorganization into different clusters and the onset of system-specific phase-shifts (heralded by over-productivity and fluctuations), (3) the final steady state shows coherent clusters and uniform patterns with large internal coupling strength and stability. The framework used allows for the spotting of system-specific growth curves, facilitates reliable prognoses concerning the child's cognitive and linguistic future and serves as a vital toehold in the onset of efficient intervention programmes.

Robert J. Porter, Directions for Mental Health, Clearwater, Florida, *rjporter@mindspring.com,* www.mindspring.com/~rjporter
Susan Mirow, University of Utah School of Medicine, *susanmirow@aol.com*
Sun 9:30-11:00 Session, Room 208

Temporal Scales and Order Parameters of Heart Rate Variability

Nonlinear systems generate temporal structure at every level of biological organization, from the dynamics of molecular reactions in cells, to that of societies of brains. One commonly studied bio-temporal structure is heart rate variability. Heart rate variability is organized at many temporal levels, from the millisecond structures of spreading heart muscle excitation to the seconds or minutes of adaptation involved in CNS-mediated cardiac responses to changes in blood chemistry or posture. This short-term temporal structure of heart rate variability has been examined in a number of different ways, including spectral analysis, wavelet decomposition, and graphical analysis procedures. We will review some of these analyses, with special emphasis on ways that nonlinear biological processes generate temporal structure linked to possible cardiopulmonary system order parameters. We will also present new data showing how analysis of heart rate variability on the macro temporal scale (that is, minutes or hours) may reveal how nonlinear biological processes generate temporal structure tied to order parameters of the psychobiological system. Our analyses suggest that the temporal structure of biological processes such as heart rate variability may span a wide dynamic range and may provide, therefore, an ideal system for simultaneously observing order (and disorder) in biological processes across levels of organization. (Supported in part by Copperton Place and Cumming Foundation).

Michael A. Radin, Department of Mathematics & Statistics, Rochester Institute of Technology
marsma@osfmail.isc.rit.edu
Sun 9:30-11:00 Session, Room 208

Applications of Difference Equations in Mathematical Biology

We will examine several difference equations as epidemic models, grass growth models, and population models. In particular, we will discover how the long-term dynamics of the solutions depend on the relationship of the coefficients and not on the initial conditions. Also, time permitting, we will also examine how the delays of some of these equations affects the long-term bahavior of the solutions.

Hector Sabelli, Chicago Center for Creative Development, *Hector_Sabelli@rush.edu,* http://creativebios.com/
Arthur Sugerman, Chicago Center for Creative Development, *art@ergodev.com*
Lazar Kovacevic, Chicago Center for Creative Development, *lakinekaki@yahoo.com*
Louis Kauffman, University of Illinois at Chicago, *kauffman@uic.edu,* www.math.uic.edu/~kauffman
Sat 14:00-15:30 Session, Room 208

Bios, Bios Data Analyzer and the Biotic Features of Galactic Evolution, DNA Sequences and Heart Rate Variation

Our research program is developing a science of creative processes by (1) identifying the defining features of creative phenomena in empirical processes; (2) developing methods to measure them in time series; (3) formulating mathematical models; and (4) experimenting with these models to identify their essential features in order to generate strategies to promote creative human behavior. In this symposium, we shall describe new time series analyses that measure the defining features of creative processes: diversification [Sabelli and Abouzeid, NDPLS 7: 35-47, 2003], novelty [Sabelli, NDPLS. 5: 89-113, 2001], and nonrandom complexity [Sabelli, Systems Analysis Modeling Simulation 42: 395-403, 2003].

To reveal simple and complex patterns in creative processes, the Bios Data Analyzer constructs vectors of 1, 2,.., N consecutive terms of the time series as well as differences between consecutive terms, differences of differences, etc., up to the tenth difference, and computes statistical, dynamic and recurrence measures for each of these series. Changes in variance with embedding demonstrate diversification in biotic and stochastic series but not in stationary chaos. Plots of recurrence of isometric vectors as a function of vector duration differentiate order from creative organization. Consecutive

isometry reveals causal or periodic order, and distinguishes chaos and bios from stochastic noise. Novelty and arrangement (nonrandom complexity) at high embeddings define creative phenomena generated by bios and stochastic noise. Embedding plots thus differentiate three types of aperiodic series: chaotic (low dimensional order and high dimensional randomness), stochastic (low dimensional randomness and high dimensional novelty and arrangement), and biotic (low dimensional order and high dimensional novelty and arrangement).

Biotic features are evident in diverse processes: physical (galactic distribution between 100 and 400 megaparsecs, atmospheric temperature), biological (heart rate variation, respiration, some DNA base sequences), and economic (prices of some commodities, exchange rates, some economic indicators).

Biotic patterns are generated by a number of nonlinear equations previously described [Chirikov and others] and investigated as a model for deterministic diffusion. We regard bios as paradigmatic of creative processes [Kauffman and Sabelli, Cybernetics and Systems 29: 345-362, 1998] and identify the process that generates it as a dialectic interaction of opposites and more specifically as bipolar feedback. Bios is defined as a deterministic process that generates episodic patterns, diversification, asymmetry, novelty, and nonrandom complexity. Bios is also characterized by irreversibility, lower entropy and greater continuity, asymmetry and sensitivity to initial conditions than chaos. Bios represents determined creation, stochastic noise random creation, and chaos "determined randomness." The demonstration of biotic features in fundamental structures supports the notion that bios and bipolar feedback may be major contributors to natural creative processes currently attributed to chaotic and stochastic processes. This indicates that creativity can be fostered by the interaction of opposites and diminished by one-sidedness.

Francois G. Schmitt, CNRS, Wimereux Marine Station,UMR ELICO, *francois.schmitt@univ-lille1.fr*
L. Seuront, CNRS, Wimereux Marine Station, UMR ELICO, *laurent.seuront@univ-lille1.fr*
S. Souissi, University of Lille 1, Wimereux Marine Station, UMR ELICO, *sami.souissi@univ-lille1.fr*
Sat 11:00-12:30 Session, Room 220
Marine Ecosystem Complexity: Scaling and Nonlinear Variability in Plankton Dynamics

The question of scale is critical for marine ecosystem studies. Approaches that deny such a basic point have no way to perform a transfer of scales, in both downscaling and upscaling contexts. Contrary to terrestrial ecosystems, in the oceans the primary production is performed by unicellular organisms called phytoplankton. The population dynamics of numerous and diverse planktonic organisms consequently occur at small scales. From the recent emerging question of the transfer of scales one can mention the understanding of the microscale nature of plankton behaviour and dynamics, and the subsequent effects of microscale variability on large scale processes, such as global biogeochemical fluxes. We study here plankton variability as multiscale patterns, and consider their structure as an adaptation to their highly intermittent turbulent environment. We first specifically consider phytoplankton concentration data and compare it to passive scalar turbulence. Then we focus on the feeding behaviour of small planktonic crustacean using new cinematographic techniques allowing to record 2D and 3D trajectories in different experimental conditions. These datasets are analysed within the framework of multifractal anomalous diffusion. After characterising these patterns we develop individual-based models (IBMs) based on multi-agent systems and other artificial intelligence techniques. These simulations allowed to demonstrate how relatively simple behavioural rules may give rise to complex collective patterns. Finally the role of both experimental and numerical approaches in studying the complexity of plankton dynamics is discussed.

David Schuldberg, Department of Psychology, The University of Montana, *py_das@selway.umt.edu*
http://psychweb.psy.umt.edu/faculty/schuldberg/schuldberg.html
Jennifer A. Waltz, Department of Psychology, The University of Montana, *jwaltz@selway.umt.edu,*
psychweb.psy.umt.edu/faculty/waltz/waltz.html
Sun 9:30-11:00 Session, Room 220
Dynamic Correlates of "Emotional Numbing"

The symptoms and experiences of emotional avoidance, lack of emotional expressivity, or "emotional numbing" are central in descriptions of Post-traumatic Stress Disorder (PTSD). The current study builds on previous work on the statistical relationships between chaos, complexity, and information indices -- derived from near-instantaneous emotion ratings -- and measures of depression and anhedonia. It examines numbing in the context of momentary joystick ratings made by participants who were watching their partner in a videotaped discussion. Dynamic indices derived from these time series are related to measures of numbing both internal and external to the videotape rating procedure. The participants are approximately thirty female survivors of Child Sexual Abuse who participated in a study of couples relationships. The participants watched a split-screen image of their partner videotaped while self and partner were discussing a conflictual situation; they used a joystick to make ongoing ratings (ranging from negative to neutral to positive) of how they had been feeling during the taped session. The joystick procedure also allowed participants to report a lack of emotion or numbing. Complexity indices derived from the emotion ratings are related to measures of numbing from the joystick procedure and also correlated with more macroscopic self-report measures of PTSD symptomatology in order to identify dynamic correlates of the experiences of emotional numbing, avoidance, or distancing.

M. Spohn, Graduate School of International Studies, University of Denver, *mspohn@du.edu*
Sun 11:30-12:30 Session, Room 220
Is the Universe Winding Down, or Is It Just Us? A Philosophical and Mathematical Challenge to Entropy

Entropy, the Second Law of Thermodynamics, points to the unfolding of time and events as being linear and irreversible. As far as we know, entropy will continue increasing, consistently and unidirectionally, until the universe is simply a uniform puddle of radiation. There are several potential

challenges to its linearity and reversibility, however, from behavior of particles at the quantum level to human perception, by necessity the inventor of linearly-experienced time. Further, proof of the behavior of the law of entropy in physics is currently based on linear statistical probability. That is, while there is nothing in the basic laws of physics that suggests that a broken teacup cannot spontaneously reassemble and hop back up on a tabletop, the number of microscopic components making up the macroscopic system of the teacup make such a reassembly statistically unlikely. But this too is a mere linear reversal of a specific linear action. If one chooses to use analytical tools other than linear statistical probability, the rules change. This study challenges the notion of the linear and unidirectional process of entropy and, by extension, the linear and unidirectional experience of time.

H Eugene Stanley, University Professor, Boston University, *hes@meta.bu.edu,*
http://www.bu.edu/smec/stanley.html
Fri Evening Keynote, Room 208
Universality And Scale Invariance: Organizing Principles That Transcend Disciplines
After a very short introduction to some of the more basic unanswered questions in the field of complex systems, we consider the problem of ``rare events". At one time such rare events were considered ``statistical outliers" because they did not conform to known probability distribution functions. Nowadays it is becoming widely appreciated that even extremely rare events may not be ``outliers" but rather may conform to newly-uncovered empirical laws, such as the various power laws characterizing scale invariant phenomena. Further, these laws appear to be ``universal" in the sense that they hold across a range of widely different phenomena, consistent with the intriguing possibility that these phenomena have some underlying features in common.

We will illustrate this feature by discussing a few examples drawn from the social sciences, economics, and the physical sciences. For example, in economics, we have demonstrated a power law distribution of returns with exponent 3, outside the Levy-stable regime, which encompasses all economic fluctuations measured to date, including data taking place in times of market crashes [1-4]. Another example concerns social networks, encompassing sexual networks [5-6]. We especially focus on a number of topics in threat networks (Al Qaeda) and threatened networks (computer networks, and SARS-susceptible networks) [7].

We also discuss how interdisciplinary ``social scientist/physical scientist" collaborations are beginning to gain theoretical insight and understanding of these new empirical laws using concepts drawn from both the social sciences and the physical sciences.

The economics research reported was done primarily in collaboration with Y. Aberg, L. A. N. Amaral, L. Braunstein, S. V. Buldyrev, R. Cohen, C. Edling, X. Gabaix, S. Havlin, P. Gopikrishnan, F. Liljeros, and V. Plerou. and has been supported by ONR and NSF.

[1] R. N. Mantegna and H. E. Stanley, Introduction to Econophysics: Correlations and Complexity in Finance (Cambridge University Press, Cambridge, 2000).

[2] V. Plerou, P. Gopikrishnan, X. Gabaix, and H. E. Stanley, ``Quantifying Stock Price Response to Demand Fluctuations," Phys. Rev. E 66, 027104-1 -- 027104-4 (2002) cond-mat 0106657.

[3] V. Plerou, P. Gopikrishnan, and H. E. Stanley, ``Two-Phase Behaviour of Financial Markets," Nature 421, 130 (2003). cond-mat/0111349.

[4] X. Gabaix, P. Gopikrishnan, V. Plerou, and H. E. Stanley, ``A Theory of Power-Law Distributions in Financial Market Fluctuations," Nature 423, 267--270 (2003).

[5] F. Liljeros, C. R. Edling, L. A. N. Amaral, H. E. Stanley, and Y. Aberg, ``The Web of Human Sexual Contacts," Nature 411, 907--908 (2001) cond-mat/0106507.

[6] Fredrik Liljeros, Christofer R. Edling, H. Eugene Stanley, Y. Aberg, Luis A. Nunes Amaral, Distributions of number of sexual partnerships have power law decaying tails and finite variance, http://arxiv.org/pdf/cond-mat/0305528

[7] Lidia A. Braunstein, Sergey V. Buldyrev, Reuven Cohen, Shlomo Havlin, and H. Eugene Stanley, ``Optimal Paths in Disordered Complex Networks." cond-mat/0305051

Richard Taylor, Department of Physics, University of Oregon, *rpt@darkwing.uoregon.edu,*
http://materialscience.uoregon.edu/taylor/taylor.html
Branka Spehar, School of Psychology, University of New South Wales, Sydney, Australia,
b.spehar@unsw.edu.au
Colin Clifford, School of Psychology, Sydney University, Sydney, Australia,
colinc@psych.usyd.edu.au
Ben Newell, Department of Psychology, University College London, London, UK, *b.newell@ucl.ac.uk*
Sat 11:00-12:30 Session, Room 208
Perception Studies of the Visual Complexity of Jackson Pollock's Dripped Fractals
Fractals have experienced considerable success in quantifying the complex structure exhibited by many natural patterns and have captured the imaginations of scientists and artists alike. Recently, we showed that the drip patterns of the American abstract painter Jackson Pollock are fractal. In this paper, we describe visual perception tests that investigate whether fractal images generated by mathematical, natural and human processes possess a common, fundamental aesthetic quality.

Claudio Tebaldi, Dipartimento di Matematica, Università degli Studi di Lecce, *tebaldi@ilenic.unile.it*
Deborah Lacitignola, Dipartimento di Matematica, Università degli Studi di Lecce
Sun 16:00-17:00 Session, Room 220
Reduction Properties in Adaptive Lotka-Volterra Systems with Symmetries
We study the properties of a n^2-dimensional Lotka-Volterra system describing competition among n different species with adaptive skills, i.e. whose interaction coefficients are time averages of the species level of interaction over their past. Starting by the case of adaptive competition among species having the same carrying capacities and birth rate, we focus our attention on the model obtained on perturbing the carrying

capacity and/or the birth rate of a fixed species, which is made more or less disadvantaged. We prove the existence of a certain class of invariant subspaces and introduce a seven-dimensional reduced model, where n appears as a parameter, which gives full account of existence and stability of equilibria in the system. The relevance of this reduced model to the complete one has also been found when the time dependent regimes have been investigated. Ecologically relevant questions, i.e. species survival and the time dependent behavior of the system have also been analyzed focusing on the role of behavioral adaptation.

Irina Trofimova, Collective Intelligence Laboratory, McMaster University, *ira@ritchie.cas.mcmaster.ca*

Diversity, Compatibility and Sociability in EVS Modeling

Sat 11:00-12:30 Session, Room 220

Diversity, compatibility and sociability could be considered as global factors affecting the development of a system, as its interaction within the developmental stages defines the specific of these stages. Establishment of interactions between agents of a population on the basis of compatibility of their configurations is associated with a first order phase transition (in clustering behaviour), common in physical systems. Compatibility of interests in making a connection makes a phase transition from a population of small clusters to an all-unified population smooth. Absence of compatibility makes this transition sharp. Diversity of agents and an ensemble architecture of connections are beneficial for the survival of a natural system functioning in a changing environment, while unification is beneficial in stable conditions. Sociability is the major factor affecting clustering behaviour in a diverse population. Diversity and compatibility have ways to control sociability, and sociability has ways to control the diversity. Artificial holding of a connection instead of compatibility condition delays the phase transition in size of population and sociability conditions, but then makes the phase transition very sharp. Stickiness of agents decreases the possibility of a 1st order phase transition, but leads to a second order phase transition, common for biological systems.

Keith Warren, The Ohio State University College of Social Work, *warren.193@osu.edu*
Dawn Anderson-Butcher, The Ohio State University College of Social Work, *anderson-butcher.1@osu.edu*
Gheorghe Craciun, The Ohio State University Department of Mathematics, *craciun.2@osu.edu*

Sun 9:30-11:00 Session, Room 220

An Application of Network Dynamics to the Aggressive Recess Behaviors of Elementary School Boys

Most aggressive behaviors among elementary school boys occur during recess (Olweus, 1993), however we have little understanding of the dynamics of the spread of aggressive behaviors. Watts (2002) derives a network model in which each individual undertakes an action depending on the percentage of the individuals with whom s/he is connected who have undertaken the action. We use this to model peer interaction driven by observational learning. Because the Watts model yields a distribution of numbers of actions per trial with a power law tail having a slope of -3/2, it is empirically testable.

Aggressive behaviors among boys were observed during the first and second halves of three successive recess periods on eighty-three school days. Log/log plots of number of behaviors and frequency of number for the two halves of the first recess period, that for first and second graders, and for the total of the second and third recess periods, those for the third and fourth and fifth and sixth graders, were constructed.

All log/log plots showed power law tails having slopes within two standard errors of 3/2 (Slope = -1.58, SE = .18; Slope = -1.8, SE = .25; Slope = -1.3, SE = .17; Slope = -1.69; SE = .272).

The power law tails imply the importance of keeping aggressive behaviors beneath the onset of the power law regime. The apparent applicability of the Watts network model suggests the possibility of exploiting network effects to block the spread of aggressive behaviors.

Olweus, D. (1993). Bullying at school: What we know and what we can do. Cambridge, MA: Blackwell.

Watts, D. (2002). A simple model of global cascades on random networks. Proceedings of the National Academy of Science, 99(9), 5766-5771.

Ralph M. Waugh, Clinical Psychology Program, School of Psychology, The Fielding Graduate Institute
waugh@mail.utexas.edu

Sat 14:00-15:30 Session, Room 224

A Self-Reflexive, Holographic Nonlinear Dynamical Systems Process-Theory of Interactional Harmony and Discord

Using systematic grounded theory methodology, analysis, and synthesis of text from 200+ peer-reviewed published, psychological secondary sources; this research focused upon what happens, moment-to-moment, during the unfolding of interactions in close, significant, well-established relationships. Results included a self-reflexive, holographic nonlinear dynamical systems process-theory of interactional harmony and discord. Initial conditions change instantaneously through interdependent intraindividual and dyadic state dynamic feedback processes. Multiple momentary iterations elicit continual self-organization of spontaneous emergences of co-constructed perceptions, expectations, cognitive-affective-psychophysiological processes, and dyadic system's behavioral trajectories.

Chad Webb, Department of Psychology, Pikeville College, *cwebb00@pc.edu*
Daniel Schnopp-Wyatt, Psychology Department, Pikeville College, *dwyatt@pc.edu*

Sun 16:00-17:00 Session, Room 208

The Chaotic Nature of Chaos Theory

From a qualitative standpoint, theories that led to a far-reaching paradigm shift had similar qualities. All had a causal barrier where understanding stopped and assumption began. This barrier served as the constant framework in which problems could be defined and later understood. The barrier served as a seed, a base, from which things were defined and understanding began. We suggest that this barrier is the edge of chaos. In science, as in theology, and in every other field of thought, an answer leads to more questions. Answers to

individual questions effect the course of study as a whole. The pursuit of understanding is a self-referential feed-back phenomenon. The recursive pattern of previous paradigm shifts give indications of the future direction of chaos theory as it reshapes science. All major scientific advancements follow a pattern of chaotic turbulence giving rise to order before advancing into the next phase of chaotic disturbance. The question becomes the answer and the answers give rise to new questions. This is exemplified by the creation and elaboration of Newtonian physics, the central dogma of biology regarding DNA synthesis and reproduction, and the heliocentric theory of Copernicus. The chaotic nature of scientific endeavor resembles matter in a super-saturated solution. For structure to form the presence of a seed crystal or strange attractor - a causal barrier in the sciences - is essential. We will present examples from the history of science and emphasize the evolution of chaos theory.

Myra Sturgeon White, Department of Psychiatry, Harvard Medical School, *mswhite@fas.harvard.edu*
Michael Lamport Commons, Department of Psychiatry, Harvard Medical School, *Commons@tiac.net*
Sat 18:15 Poster Session, Outside Rooms 426-430

Solving Complex Problems Using Hierarchical Stacked Neural Networks Modeled on Cognitive Development

Neural networks have greatly improved our ability to model human behavior and solve complex problems. Their success lies in their ability to model neuronal function and organization within the brain. However, because we have not yet identified how combinations of neurons produce complicated behavioral sequences, neural networks are not able to fully mimic the brain's capacity to combine behaviors in novel ways to solve complex problems. As a result, they cannot solve complex problems that humans solve easily. Our work adds a new dimension by creating hierarchical stacked neural networks that model how humans acquire complex behavioral sequences. We present a blueprint for designing neural networks that incorporate Commons' Model of Hierarchical Complexity (1998) and thus, more closely parallel the behavioral learning process in humans with its capacities to flexibly solve and respond to complex problems. Commons' Model is based on research showing that cognitive development in humans proceeds through a series of ordered stages. Actions and tasks performed at increasingly higher stages are built on each proceeding stage. Hierarchical stacked neural networks in our design parallel this process by being ordered in the same way as the developmental learning sequence outlined in Commons' model. The mathematical models used within each network in a stack are based on its developmental stage and not the logic of a task. Using our model, we have designed a system that directs incoming customers' calls to correct departments in a large organization based on customers' oral statements and responses to questions asked by the system.

George R. Williams, Media Bureau, Federal Communication Commission, *George.Williams@fcc.gov*
Sat 9:00-10:30 Session, Room 220

Recurring Symbols and Patterns in Gift Exchange

A number of authors have suggested that gift exchange, distinct from ordinary monetary exchange or trade, promotes social bonding and coherence in a society. In this paper, we explore a number of symbols associated with gift exchange that recurr across a number of cultures. The class of prominent symbols that recurr suggest that gift exchange may be linked with fertility and rituals that link a community with the land.

Susan Yoon, Ontario Institute for Studies in Education of the University of Toronto, *syoon@oise.utoronto.ca*
Eric Klopfer, MIT, *klopfer@mit.edu*
Earl Woodruff, Ontario Institute for Studies in Education of the University of Toronto, *ewoodruff@oise.utoronto.ca*
Latika Nirula, Ontario Institute for Studies in Education of the University of Toronto, *lnirula@oise.utoronto.ca*
Hal Scheintaub, Governor Dummer Academy, Boston, *hscheintaub@gda.org*
Sat 9:00-10:30 Session, Room 220

Investigating How a Wearable Computer Technology (Thinking Tags) Influences Opinion Dynamics

Recent educational simulation and modeling tools have provided innovative opportunities for students and teachers to develop a complex systems understanding about how natural and social systems operate. In this interactive poster we report on a study aimed at investigating how the public display of first-person information mediates interactions between social and cognitive domains of learning. We specifically use a micro-computer technology developed at MIT called a "Thinking Tag" that communicates through infrared and can be programmed to represent various characteristics of the wearer. Our findings indicate that this technology has great potential as a tool for tracking the understanding that emerges as students learn about complex scientific issues. The feedback and amplification of ideas reveal important decision-making processes (that normally remain hidden) in discursive classroom contexts. Participants in this session will be required to wear a "Thinking Tag", formulate an opinion on an issue based on the theme of this conference, and discuss their opinions with other participants.

Aleksander Zidansek, J. Stefan Institute, *aleksander.zidansek@ijs.si*
Sat 16:00-17:00 Session, Room 208

Application of the Chaos Theory in Sustainable Development Modeling

Sustainable development has been suggested in 1987 by the Brundtland Commission in preparations for the Rio Earth Summit in 1992 as a theoretical concept, which is aimed to solve a difficult global problem how future development of human civilization can remain within the bounds of environmental and social limits. It is at present impossible to prove that such a solution is possible also in practice. An attempt to address this question is given by the analysis of time series of sustainable development indicators as a self organized phenomenon. Limits to growths from the environmental and social perspective are studied, and different scenarios for innovative solutions are explored in order to provide qualitative advice for optimal strategy of individual

players in the global world from the sustainable development point of view. Growth of a value-based knowledge network is suggested as a tool to improve sustainability of the global economic system.

New Publisher for NDPLS

(continued from page 1).

web site for single article sales. Kluwer had finalized arrangements last year to make *NDPLS* and most of their other journals available for single article retrieval through facilities such as Ingenta and Proquest. SCTPLS plans to maintain, if not also expand, the presence of *NDPLS* through these facilities in the coming years.

Our Editor continues, "In order to make the production side of *NDPLS* work, we are going to have to place more responsibility on our authors for copy editing and preparing their final manuscripts. We've been letting people slide a bit with the Editor making copy edits and passing them on to the publisher who would get them done somehow. We must also be more demanding about proper formats, especially where electronic files are concerned. Many of the big publishers act like they are not fussy about file types. We have already discovered, however, that if a standard manuscript has to be run through a scanner because the proper e-files were not available, and then corrected for 'scannerese,' four or five hours of labor can be easily shot. To make things easier for authors, however, we now have an expanded *Instructions for Authors* file on the new *NDPLS* web site. The Instructions document is also formatted as a template that authors can use to set up the WORD word-processing files.

"We are also fortunate that the *NDPLS* Editorial Board is staunchly behind our transition efforts. Several of them are enthusiastically preparing new works. Also an e-mail went out to all the speakers at the 13th Annual International Conference of SCTPLS invited them to submit their finished papers to the journal."

New Web Site

NDPLS has a refreshed web site, thanks to the diligence of the Society's new Webmaster Terrill Frantz. The easy-access menu allows visitors to access *NDPLS* contents, the Instructions for Authors, the 1997 Editorial that started the journal, and the new 2004 Editorial, "Progress in Applied Nonlinear Dynamics," plus other business-related information. Many of the graphic elements reverberate the new cover design.

New Cover and Art Feature

Neither the SCTPLS officers or editors could resist the opportunity to redecorate the *NDPLS* cover. The new plan is to keep a standard layout in black type on white as initially shown, with a colorized fractal design that changes (design and color) with each issue. The graphic choices are coupled with an art feature article. The art feature article for Jan 2004 will be "Can a Monkey with a Computer Generate Art?" by J. C. Sprott. There's a sequence of 4 cover design associated with that feature.

The design layout was produced by Holly Arrow, Dick Bird, Kevin Dooley, Steve Guastello, and Mary Ann Metzger. They worked through a number of design ideas, discarded most of them, and landed on the layout that was finally adopted. Holly, our President-Elect worked as a graphics designer in a past life. Steve had worked on one of the very first IBM word processing machines in the mid-1970s. Holly and Steve both remember the days when the verb "cut" involved a razor blade, T-square, and light table; and the verb "to paste" involved hot wax.

Special Issue on Agent-Based Models

The Editors are pleased to announce a special issue on Agent-Based Modeling, which will appear in Volume 8. Euel Elliott and L. Douglas Kiel will be guest editors for that issue. The papers that have been accepted for that issue are listed below along with other articles that have been accepted for October, 2003, or other issues in 2004.

Manuscripts Accepted for NDPLS

Arifovic, J., & Masson, P. Heterogeneity and evolution of expectations in a model of currency crisis.

Bankes, S., & Lempert, R. Robust reasoning with agent-based modeling.

Behrens, D. A., Caulkins, J. P., & Feichtinger, G. A model of chaotic drug markets and their control.

Dal Forno, A., & Merlone, U. Personnel turnover in organizations: An agent-based simulation model.

Dooley, K., & Corman, S. Dynamic analysis of news streams: Institutional versus environmental effects.

Goldstein, J. The construction of emergent order, or, how to resist the temptation of hylozoism

Gregson, R. A. M. Transitions between two pictorial attractors.

Guastello, S. J., & Bond, R. W. Jr. Coordination in stag hunt games with application to emergency management.

Guerin, S., & Kunkle, D. Emergence of constraint in self-organizing systems.

Henrickson, L. Trends in complexity theories and computation in the social sciences.

Phelan, S. E. Using agent-based simulation to examine the robustness of up-or-out systems in universities.

Popivanov., D., Janyan, A., Andonova, E., & Stamenov, M.. Common dynamic properties of biosignals during cognition: Self-similarity and chaotic dynamics of both response times and EEG during movement imagery

Richardson, K. The problematisation of existence: Towards a philosophy of complexity.

Schank, J. C. Avoiding synchrony as a strategy of female mate choice.

Spinelli, G. Heterochromatin and complexity: A theoretical approach

Sprott, J. C. Can a monkey with a computer create art?

Yuan, Y., & McKelvey, B. Situated learning theory: Adding rate and complexity effects via Kauffman's NK model.

Nonlinear Dynamical Bookshelf

Book Review

Chaos and Time-Series Analysis. **By Julien Clinton Sprott.** New York & Oxford, UK: Oxford University Press. xx + 507 pp; 298 figures. ISBN 0 19 850839 5 (hardback), 0 19850840 9 (paperback). $85/$45 (hardback/paperback, US), £25.95/£49.95 (hardback/paperback,UK).

(1) Introduction: Intended Audience

I wanted a book to advance my own knowledge of dynamics. I got Sprott's book to evaluate for this purpose, as he is a master at dynamics and has a knack for explaining things clearly and succinctly. It was a question as to its appropriateness for my own level of mathematical background, which I consider particularly sophisticated but rather representative of many dynamical enthusiasts in our fields of biological, psychological, and social sciences. So I am reviewing this book as to the appropriateness of its use as a teaching/learning instrument in these fields, and as to its success in clarity and completeness of meeting that challenge.

A fast skim through the book showed it to be comprehensive, but possibly a bit daunting to those of us whose mathematics is limited to basic algebra, finite mathematics, and introductory calculus, as it includes topics such as Jacobian matrices of partial differentials, KAM tori, Lipshitz-Hölder exponents, Legendre transforms, and so on (things that just scare you if you haven't encountered them before). But closer examination of each of them makes them seem quite tractable, and when you return after the first fast skim though the book, you read the preface and it sets your mind at ease, and tells you this is a book that will provide a great, complete, and manageable foundation in chaos theory and data analysis.

In his preface, Sprott explains that the book arose from a survey course he taught for upper-level undergraduate students, graduate students, and "other researchers, representing a wide variety of fields in science and engineering" As he puts it,

> "This book is an introduction to the exciting developments in chaos and related topics in nonlinear dynamics, including the detection and quantification of chaos in experimental data, fractals, and complex systems . . . [mentioning] most of the important topics in nonlinear dynamics. Most of the topics are encountered several times with increasing sophistication." The emphasis is on concepts and applications rather than proofs and derivations and is for "the student or researcher who wants to learn how to use the ideas in a practical setting, rather than the mathematically inclined reader who wants a deep theoretical understanding.
>
> "While many books on chaos are purely qualitative and many others are highly mathematical, I have tried to minimize the mathematics while still giving the essential equations in their simplest form. I assume only an elementary knowledge of calculus. Complex numbers, differential equations, matrices, and vector calculus are used in places, but those tools are described as required. The level should thus be suitable for advanced undergraduate students in all fields of science and engineering as well as professional scientists in most disciplines." (From the preface.)

It delivers on all these promises. Further, it is 'hands-on', with practical exercises and a programming project in each chapter. (Any language and computer platform will do; spreadsheets or math packages such as *Maple* or *Mathematica* may also be used if one is already capable with them. If one is not fluent in a programming language he suggests *PowerBASIC*—DOS or Windows versions—for its ease of learning). I found that having a dynamics program, such as *Berkeley Madonna* (Macey, Oster, & Zahnley, 2000) that will solve equations into graphic displays was most useful for additional explorations. Thus Sprott's book is most suitable for systematic study, but as with most textbooks, it can also serve as a useful reference work in your library. You may also find the programs by Sportt and Rowlands, useful supplements to the text, *Chaos Demonstrations* (1995) for examples of several programs, and *Chaos Data Analyzer* (1995), for data analyses.

(2) Contents

The 15 chapters cover the following topics: Introduction, One-dimensional maps, Nonchaotic multi-dimensional flows, Dynamical systems theory, Lyapunov exponents, Strange attractors, Bifurcations, Hamiltonian chaos, Time-series properties, Nonlinear prediction and noise reduction, Fractals, Calculation of the fractal dimension, Fractal measure and multifractals, Nonchaotic fractal sets, and Spatiotemporal chaos and complexity. In addition, there are three fantastic appendices. The first is a catalog of Common chaotic systems, there being 62 given, in five categories: noninvertible maps (12), dissipative maps (11), conservative maps (6), driven dissipative flows (8), autonomous dissipative flows (20), and conservative flows (5), each with a graph, equations, typical parametric values and initial conditions, Lyapunov exponents, Kaplan-Yorke dimension, correlation dimension, and a major reference. The second appendix gives useful mathematical formulas in ten categories: trigonometric relations, hyperbolic functions, logarithms, complex numbers, derivatives, integrals, approximations, matrices and determinants, roots of polynomials (including the Newton-Raphson method), and vector calculus. And the third appendix is a list of relevant journals. The bibliography of 715 entries covers everything from Abarbanel (1996) to Zipf (1949). Ruelle and Grassberger are the most cited senior authors (9 each), with Bak, Theiler, L. A. Smith, Grebogi, Arnold, Mandebrot, Lorenz, Sauer, and Schreiber also having 5 or more citations each. The oldest citation award goes to Huygens, 1673. There is an excellent support page with color versions of many of the figures and much supplementary information (including answers to some of the exercises) at

http://sprott.physics.wisc.edu/chaostsa/. It is continually updated, and contains many important links to other related pages of both his (such as the pages for the course that spawned the book) and on other websites.

I provide additional comments on each chapter in an extended prepublication review of the chapter contents at www.blueberry-brain.org\dynamics\srpott.htm His final concluding remarks are of special interest to me, as they reflect the way I used to finish off many of my articles, issues also emphasized by Christine Hardy (1998), and they deal with issues of free will and responsibilities, social, ecological, and for Sprott, aesthetical, for a more beautiful world.

(3) Conclusion and recommendations

I consider this book an indispensable addition to my bookshelf. I intend to use it to get a good foundation in almost all aspects of dynamical systems theory, especially, of course, chaos theory and data analysis. For those with the minimum recommended mathematical background (elementary calculus and some matrix algebra), some of the book might seem a bit foreboding, but as Sprott promises, the explanations and support material will fill in the necessary updating of your mathematics. In most instances the explanations were clear, and covered almost all related aspects of each subject. It was very impressive. Occasionally I found myself struggling with keeping the meanings of indices straight with the matrix algebraic expressions, but much less so than in any other similar book that I have encountered. The later chapters sometimes tried to compress so many topics into them, that the compression demanded some supplementation from the web sources or other books. I suspect that if you do the exercises and programming projects, that you will find them very challenging but very rewarding. The extensive and evolving website back-up makes the book unique and even more valuable. It stays up to date as the field evolves. The book is thus perfect for self-instruction, or for use as a classroom textbook, and of course, as a reference work for workers in any field of science.

I'd like to end the review with my recommendations for a basic bookshelf . For learning dynamics, the two books I consider most important are this book of Sprott's, and that of Ralph Abraham and Christopher Shaw, *Dynamics: The geometry of behavior* (1992) on visualization. Between them they give the basic elements of theory and data analysis. Others that I like are mentioned in the extended review.

Book Review

***The Nonlinear Workbook*, 2nd Edition. By Willi-Hans Steeb, in collaboration with Yorick Hardy and Ruedi Stoop.** New Jersey: World Scientific, 2002. 622 pages, paperback ISBN 981-238-230-5.

This amazingly comprehensive reference book is a set of mathematical notes on most of the better-known technical methods for creating, identifying and controlling nonlinear dynamics, and for each C++ programs for their implemen-tation. A list of part of the contents includes chaotic maps, invariant density, Lyapunov exponents, auto-correlations, discrete and fast Fourier transforms, circle maps and rotation number, Feigenbaum's constant, symbolic dynamics, phase portraits, correlation integral, hyperchaos, Lyapunov exponent from time series, correlation coefficient, Jacobian matrix estimation, homoclinic orbits, Lotka-Volterra systems, Hamilton systems and first integrals, nonlinear dissipative systems, Hopf bifurcation, Poincaré section, the Ott-Yorke-Grebogi method, Resonant perturbation and chaos control, Synchronization of chaos, fractals, Cantor sets, Julia set, Weierstrass function, one- and two-dimensional cellular automata, Runge-Kutter-Fehlberg technique, invisible chaos, Neural Networks, Basins and radii of attraction, spurious attractors, asynchronous operation, Kohonen network, multilayer perceptrons, back-propagation algorithm, genetic algorithms, gene expression, wavelets, fuzzy sets and fuzzy logic, defuzzification operators, and more (sorry, I also found Hausdorff dimension and Hurst exponent).

The programs are in C++, Java and Symbolic C++. This is both a strength and a weakness, but I think it brings home the fact that in order effectively to work in cutting-edge nonlinear dynamics you should either be able at least to read what C++ is doing, or work with a colleague who can read and write the code. If like this reviewer you are not a C++ practitioner, but can read algebra, then there are other sources of code, and you can work from the given algebra, that is succinct and relevant, to write you own code. C++ is so dense compared, say, with old-fashioned Fortran that it is difficult to eyeball a source code listing and see where you want to correct or amend and explore the consequences. That is always a good thing to do once, in order to get the feel of numerical approximations and how those can introduce spurious chaos when you jump from continuous functions to maps. If you merely want to compute, but not to know what is inside programs to evaluate indices such as Lyapunov exponents, then the commercially available programs such as those from the Physiology Department at the University of Aachen will be fine, if your data are extensive enough. But unfortunately real psychological data are so often too brief, too transient and too unstable for using with some packages that are written for physiology, engineering, or economics. The extensive discussions on when deterministic models on real data are still informative, though obviously over-simplified, which make Murray's *Mathematical Biology* (2002) so salutary, should be taken to heart.

But a book like this is one that is intended to be used with problems of a greater diversity than the specific (and by now almost classic) examples given. It is helpful to have theoretical texts such as Gumowski and Mira (1980) handy, and if your data do not admit to having identifiable of metric properties then, before going to symbolic dynamics, read parts of Meyn and Tweedie (1993). I have also found that some parts of *Mathematica* software that handle algebraic functions in matrix algebra are not covered by Steeb, as historically their origins are not part of nonlinear dynamics, but they certainly can be used to tease out differences between data sets. I cannot resist ending by citing a remark by a leading British statistician in a volume of *Proceedings of the Royal Statistisical Society Series B* (Methodological) whose volume number I have now mislaid.:

"Statistics is not about calculating significances, it is about finding pattern and structure in data". The tools that Steeb has collected are most of the ways we presently

If undeliverable return to:

Society for Chaos Theory in Psychology & Life Sciences
Department of Psychology, MARQUETTE UNIVERSITY
P. O. Box 1881, Milwaukee, WI 53201-1881 USA

FIRST CLASS AIRMAIL EVERYWHERE

Continued from p. 23

have to search for the structures that are peculiar to and in fact define nonlinear dynamics.

References

Gumowski, I. & Mira, C. (1980) ***Recurrences and Discrete Dynamic Systems*** **(*Lecture Notes in Mathematics*, vol. 809.)** Berlin: Springer-Verlag..

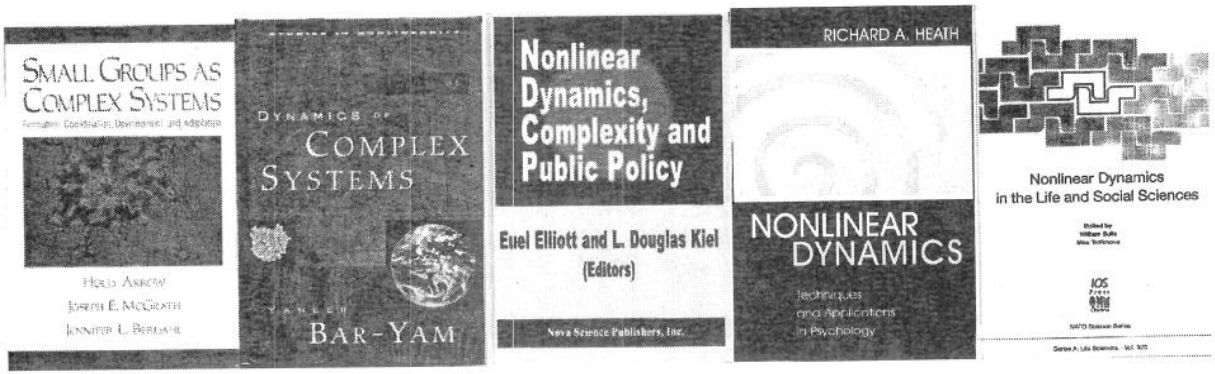
Meyn, S. P. & Tweedie, R. L. **(1993) *Markov Chains and Stochastic Stability*.** (In the ***Communications and Control Engineering Series*).** London: Springer-Verlag.

Murray, J. D. (2002) *Mathematical Biology*. 3rd Edition, in two volumes. New York: Springer.

INSIDE ---

13TH ANNUAL SCTPLS BOSTON AUG. 8-10 2003

Conference Abstracts & Authors Issue!



Terrill L. Frantz 2003
Organization Simulations Asia Ltd.
6/F The Landmark East
12 Ice House Street
Central
HONG KONG