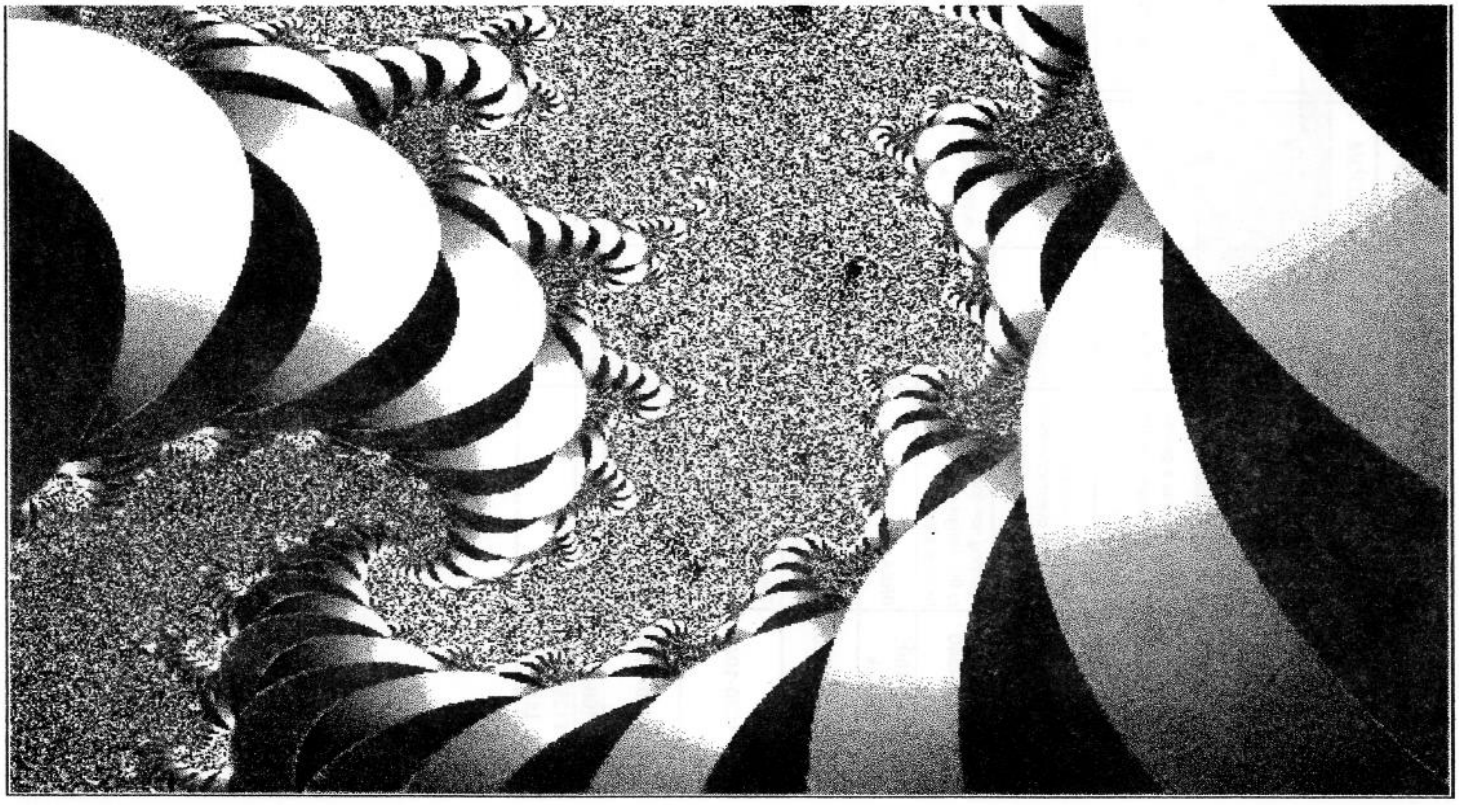
Society for Chaos Theory in Psychology & Life Sciences

NEWSLETTER

Kevin Dooley, Ph.D., President; Robert Porter, Ph.D, Editor; Stephen Guastello, Ph.D., Production Editor
Vol. 8 No. 4, August, 2001

11th Annual International Conference Program Issue
Room Schedule - All events take place in the Grainger Conference Center

FRIDAY	**Aug. 3**	**SUNDAY**	**Aug. 5**
Room	Event	Room	Event
Atrium	Registration and Book Store	Atrium	Late workshop registration, books
2290	Intro Dynamics Workshop	5120	Venue A
Atrium	Reception	2120	Venue B
2120	Opening night Plenary Session		
SATURDAY	**Aug. 4**	**MONDAY**	**Aug. 6**
Atrium	Registration and Book Store	Atrium	Biz desk, books until 12 noon
2190	Venue A	2080	SCTPLS Business Meeting
2180	Venue B	1270	Organizations Workshop
1175	Venue C	2175	Biopsychology Workshop
5120 AB	Banquet & Speaker		



Summer, 2001 - SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY AND LIFE SCIENCES - Madison, WI

	SATURDAY	AM	ROOM	SATURDAY	AM	ROOM	SATURDAY	AM	ROOM
0800-0820									
0820-0840				The Bipolar Logistic Equation and the Concept of Mathematical Development	Sabelli	MATHEMATICS B	*Nonlinear Paths-Not-Taken*	Abraham	SYMPOSIUM C
0840-0900	Is schizophrenia a genetic disorder? Perspectives from n-bind theory	Koopmans	CLINICAL PSYCHOLOGY A	Information defined as energy: impact on the process of self-organisation	Toifl	MATHEMATICS B	*Nonlinear Paths-Not-Taken*		SYMPOSIUM C
0900-0920	Expressed emotion, emotional overinvolvement and n-bind indicators	Koopmans	CLINICAL PSYCHOLOGY A	On the coding of information with finite pseudorandom sequences	Jimenez-Montano	MATHEMATICS B	*Nonlinear Paths-Not-Taken*		SYMPOSIUM C
0920-0940	Applying non-linear models to the design of 'intelligent' hearing aids	Walker	PHYSIOLOGY A	Trigonometric Chaos and Bios	Sabelli	MATHEMATICS B	*Nonlinear Paths-Not-Taken*		SYMPOSIUM C
0940-1000 Break	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK
1000-1020	Is Chaos Still Good for You? - Goldberger's hypothesis revisited	Bird	PHYSIOLOGY A	Simulations of an agent-based model	Tabata	MATHEMATICS B	*Archetypes and Dynamics within a Unitary Reality*	Sulis	SYMPOSIUM C
1020-1040	The significance of Information for the development of healthy or Ill states	Toifl	PHYSIOLOGY A	Diversification, equilibration, and embedding correlation	Sabelli	MATHEMATICS B	*Archetypes and Dynamics within a Unitary Reality*		SYMPOSIUM C
1040-1100	Applications of Difference Equations in Mathematical Biology	Raden	PHYSIOLOGY A	Functional Differentiation in EVS models	Trofimova	MATHEMATICS B	*Archetypes and Dynamics within a Unitary Reality*		SYMPOSIUM C
1100-1120	PLENARY	PLENARY	PLENARY	PLENARY	PLENARY	PLENARY	PLENARY	PLENARY	PLENARY
1120-1300 LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH

	SATURDAY	PM	ROOM	SATURDAY	PM	ROOM	SATURDAY	PM	ROOM
1300-1320	A fractal investigation of physical factors in human settlement behavior	Sambrook	SOCIOLOGY A	Self-organization of landscape patterning	Bolliger	ECOLOGY B	* Spatial patterns of phase in the gamma EEG	Freeman	Neurocognitive Synchronization Symposium C
1320-1340	Ups and downs: A dynamical systems model of human affective fluctuations	Warren	SOCIOLOGY A	Swarmsara: An Artificial Life Approach to Buddhist Land Resource Management	Turner	ECOLOGY B	* Ultradian rhythms and control of chaos	Mirow	Neurocognitive Synchronization Symposium C
1340-1400	The Many Facets of the Holy Grail	Williams	SOCIOLOGY A	Econophonia: A Sound Economic Analysis	Viotti	ECONOMICS B	* Introducing control and synchronization, review and examples.	Orsucci	Neurocognitive Synchronization Symposium C
1400-1420	Chaotic Components in Arts and Architecture	Sala	SOCIOLOGY A	The Great Depression: Computer Simulation of a Complex Catastrophic Event	Pasdirtz	ECONOMICS B	* New media, learning and synchronization	Sala	Neurocognitive Synchronization Symposium C
1440-1500 BREAK	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**
1500-1520	Further up the Holler: The Fractal Nature of the Internalized Hillbilly Stereotype	Howie	SOCIOLOGY A	Multiple Unofficial Economy Equilibria and Income Distribution Dynamics	Rosser, Jr.	ECONOMICS B	* Depiction of Dynamic Patterns in Self-Organized Group Formation	Arrow	Nonlinear Dynamic Analysis of Social Behavior Symposium C
1520-1540	Professor Helbing's Decision Theoretical Specification	Aruka	SOCIOLOGY A	Let It Be; Chaotic Price Dynamics can be Beneficial	Matsumoto	ECONOMICS B	* Deviancy training as an attractor: Concurrent and predictive validity	Granic	Nonlinear Dynamic Analysis of Social Behavior Symposium C
1540-1600	Avatamsaka Game Experiment as a Nonlinear Polya Urn Process	Aruka	SOCIOLOGY A	Control of Hyperchaos in an OLG Economic Model	Mendes	ECONOMICS B	* Using State Space Grids to Depict Phase Transitions in Adolescent Development	Hollenstein	Nonlinear Dynamic Analysis of Social Behavior Symposium C
1600-1620							* State space analysis of a socioemotional transition at 18-20 months	Lewis	Nonlinear Dynamic Analysis of Social Behavior Symposium C

1620-1640							
	SUNDAY	**AM**	ROOM	**SUNDAY**	**AM**	ROOM	**MONDAY AM**
0800-0820							
0820-0840	Multilevel Webs As Non-Deterministic Complex Systems	Hardy	COGNITIVE PSYCHOLOGY A	Modeling High-Resolution Broadband Discourse in Complex Adaptive Systems	Dooley	COMMUNICATION B	**Monday Business Meeting**
0840-0900	Mapping the Unpredictable: the Dynamical Nature of Mood and Emotion	Mirow	COGNITIVE PSYCHOLOGY A	Human communication as complex system: a quantitative analysis	Morgavi	COMMUNICATION B	**0900-1000 Feedback about this meeting. Planning for next years meeting and nomination of officers.**
0900-0920	Chaos Theory, Visualization And Psychogical Change	Weinberg	COGNITIVE PSYCHOLOGY A	Coupling dynamics of motion primitives in speech movements	van Lieshout	COMMUNICATION B	
0940-1000 Break	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**BREAK**	**Parallel Workshops A & B: 1030-1530**
1000-1020	Ordering, intelligence and entropy	Defourneaux	COGNITIVE PSYCHOLOGY A	Multilevel model of creative thinking and the principles of CA simulation	Aniskovich	COMMUNICATION B	**Workshop A: An Introduction to Complexity Science for Organizational Researchers** *Kevin Dooley, Arizona State University*
1020-1040	Visualizing and Quantifying Nonlinear Dynamics in Human Cognition	Heath	COGNITIVE PSYCHOLOGY A	Information & Interface	Wytenburg	ORGANIZATIONS B	**Workshop B: Nonlinear Perspectives on Rhythm, Chaos, and Control in Human Biology: A Discussion of Theories and Methods** Robert Porter, Ph.D., Workshop Coordinator, Directions for Mental Health (Clearwater FLA) & Lambda Consulting (Tampa FLA); Franco Ors
1040-1100	Memory across Eye-Movements: 1/f Dynamic in Visual Search	Aks	COGNITIVE PSYCHOLOGY A	Characterizing and Exploring the Government/Industry Cluster Time-Ecology	Koehler	ORGANIZATIONS B	
1100-1120	Modeling dynamics of operant behavior controlled by fixed-interval (FI) schedules	Li	COGNITIVE PSYCHOLOGY A	Verbalization and Personnel Replacement on Group Coordination, and Leadership Emergence	Guastello	ORGANIZATIONS B	
1120-1300 LUNCH	**LUNCH**	**LUNCH**	**LUNCH**	**LUNCH**	**LUNCH**	**LUNCH**	LUNCH

	SUNDAY	PM	ROOM	SUNDAY	PM	ROOM	MONDAY PM
1300-1320	The Self as Coagulated Interaction	Hucke	COGNITIVE PSYCHOLOGY A				MONDAY WORKSHOPS CONTINUE
1320-1340	The Chaos of Health	Martinez	COGNITIVE PSYCHOLOGY A	Coevolutionary Dynamics Over Time Using Kauffman's NK Model	Yuan	ORGANIZATIONS B	MONDAY WORKSHOPS CONTINUE
1340-1400	Picture Yourself: Exploring the Dynamics of Vision and Posture	Filippi	COGNITIVE PSYCHOLOGY A	Rugged Landscapes and Complex Supply Networks	Dooley	ORGANIZATIONS B	MONDAY WORKSHOPS CONTINUE
1400-1420	Simulating people's cognitive responses to health threats	Milne	COGNITIVE PSYCHOLOGY A	Mapping Social Ecosystems	Baskin	ORGANIZATIONS B	MONDAY WORKSHOPS CONTINUE
1440-1500 BREAK	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK	MONDAY WORKSHOPS CONTINUE
1500-1520	Nonlinear World of Dr. Suess	Marks-Tarlow	PHILOSOPHY A	Does diversity affect the ability of complex-adaptive systems to make sense	Fleeman	ORGANIZATIONS B	MONDAY WORKSHOPS CONTINUE
1520-1540	A Conversation on Emergence	Goldstein	PHILOSOPHY A	The Dynamics of Local Rules in Hospital Admission Processes	Walker	ORGANIZATIONS B	*Conference Ends 1530*
1540-1600	Is Chaos Research Normal Science?: Logical Foundations of Postmodern Inquiry	Fleener	PHILOSOPHY A	Using Complex Adaptive Systems Models for Organizational Consulting	Link	ORGANIZATIONS B	
1600-1620							
1620-1640							

SCTPLS 2001 Conference Program

FRIDAY, AUGUST 3

WORKSHOP 1000-1600

Workshop: Dynamics for Dummies

Fred Abraham, Silliman University & the Blueberry Brain Institute

This workshop will introduce some basic concepts of dynamical theory, such as state and phase space, trajectory, vector field, attractor, bifurcation, stability, chaos, self-organization, and some of their basic mathematical concepts (at a very basic level), and utilizing a few classic examples like the Lotka-Volterra and Lorenz systems plus a couple from our fields. It will also give a brief introduction to some of the research design and analysis issues, including attractor reconstruction, characteristic and Liapunov exponents, recurrence plots, false nearest neighbor, and some basic concepts of times series analysis. It will not attempt to show how to derive theory from data; just evaluate dynamical properties of data. The morning will be in lecture mode, and the afternoon will be a hands-on introduction to a couple of the simpler programs around to display theory (Madonna, which is similar to Stella) and to analyze data (Santis, beta version of Dataplore).

1700-1830 Welcome Gathering

1830- 'til Evening Program featuring J. BARKLEY ROSSER

Dr. Rosser is a Professor of Economics and the Kirby L. Kramer Jr. Professor at James Madison University. He will be discussing "The Complexities of Complex Economic Systems".

The application of complex nonlinear dynamics in economics is seen as a special case of the more general multidisciplinary development of such ideas. Arising from bifurcation theory and more general problems of nonlinear oscillations, complex dynamics have arguably evolved through four stages, the "four C's" of cybernetics, catastrophe theory, chaos theory, and complexity theory. We distinguish between "broad tent complexity" which includes all four and "narrow tent complexity" which is the latest stage which focuses on models of dispersed, heterogeneous agents who act upon each other locally to bring about larger scale emergent ordered structures. Examples of applications of all these stages in economics will be considered and their relations to applications in other disciplines as well.

SATURDAY, AUGUST 4

Symposium: SAT, 0820-9:40, C

Nonlinear Paths-Not-Taken

Frederick David Abraham, Blueberry Brain Institute, Waterbury Center

Bob Porter, Directions for Mental Health, Clearwater, FL rjporter@mindspring.com

Robin Robertson, General Editor, Psychological Perspectives

Science is "progressive," with each stage in some way building on what comes before. But sometimes science takes one path, ignoring another, simply because it's unable yet to deal with an issue. Sometimes, also, scientific trajectories depend on an interaction with contextual-cultural issues. A review of these "paths not taken" reveals that many have non-linear dynamics at their core. The panel will present ideas from a number of thinkers, across history, whose insights give additional flavor to current ideas in non-linear dynamics. These prescient thinkers go back as far as the Neoplatonists - Plotinus, Iamblicus, and Proclus - and include Bacon, Galileo, Leibniz, Baldwin, Peirce, and James. Exploring how these early thinkers struggled with nonlinear concepts informs our current struggles in stimulating and productive ways. The panel supposes this is because nonlinear processes are at work.

Mathematics SAT, 0820, B

The Bipolar Logistic Equation and the Concept of Mathematical Development

Hector Sabelli, Chicago Center for Creative Development, hsabelli@rush.edu

Natural processes spontaneously develop and decay, rather than converging to equilibrium or chaos. Such development includes both gradual phases and discontinuities. Recursions in which the parameter changes in a linear or nonlinear fashion provide models for continual but discontinuous development. The kinetic logistic equations At+1 = At * k* t * (1 - At) and At+1 = At + At * k * t * (1 - At) generate time series of bifurcations and chaos with prominent period 3, which is similar to the bifurcation diagram generated by the standard logistic equation At+1 = At * k * (1 - At) modeling scarcity. The process equation At+1 = At + k * t * sin(At) generates a different bifurcation cascade characterized by unifurcation, sudden expansion of chaos, prominent period 4, and bios, a nonstationary pattern containing

sensitive-to-initial-conditions bioperiodicities and infinitations [Kauffman and Sabelli, Cybernetics and Systems, 1998]. Other recursions of bipolar feedback such as At+1 = At + At * k * t * sin(At) and At+1 = At + (h - At) * k * t * sin(At) generate a sequence of logistic-like developments ("logons") Instead of blowing up, each logon terminates with a shift to a new transient equilibrium from which a new logon emerges, until the series converges to its attractor, either 0 or h. At appropriate initial values, the initial logon includes a biotic phase. Logons also appear as components of the time series generated by many other equations, indicating that Feigenbaum cascades of bifurcation represent a natural pattern of organization. A different road to chaos is the braid generated by recursions of the differences between successive terms of a series At-1 - At in the context of logistic, process or bipolar logistic recursions. These studies suggest how bipolar feedback can generate several types of development; the observation of logistic-like development in natural processes does not indicate their generation by scarcity. These and other results suggest the concept of mathematical development. Mathematical developments include transient attractors, just as natural evolutionary processes include transient equilibrium and homeostasis.

Clinical Psychology SAT, 0900, A

Is schizophrenia a genetic disorder? Perspectives from n-bind theory

Matthijs Koopmans , MKoopmans@aol.com

N-bind theory argues that schizophrenia is associated with contradictory patterns of interaction in the family. The theory updates traditional family interaction models, developed in the nineteen-fifties, using recent insights in nonlinear dynamical systems modeling. The traditional family interaction models of schizophrenia were discarded for lack of evidence, and because the models seemed to conflict with the empirical findings from behavioral-genetic twin comparisons and adopted studies. The findings from behavioral-genetic research have been used to demonstrate a genetic basis for schizophrenia. N-bind disputes the interpretation of these findings, and argues that family process models such as n-bind are equally capable of explaining these results in terms of dysfunctional patterns of family interaction, using contemporary nonlinear dynamical systems concepts.

Mathematics SAT, 0840, B

Information defined as energy: impact on the process of self-organisation

Karl Toifl, University of Vienna
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The traditional scientific view is to regard matter, information and energy as basically different. Knowledge from the theory of relativity, and especially from quantum physics, shows that at the micro-level, matter appears to be energy if considered from the appropriate point of view. Information has not yet been considered or discussed in this connection, or at least not adequately. For the process of self-organization, every complex system requires, in addition to matter, i.e. materially compressed energy, various types of energy, as well as information of appropriate quality and quantity. No system can function or exist without this information. This presentation deals with information from different points of view with respect to energy-related involvement in the process of self-organization. Various aspects of informational energy are described, using concrete examples, and their significance for a different interpretation of information discussed.

Clinical Psychology SAT, 0900, A

Expressed emotion, emotional overinvolvement and n-bind indicators in families with schizophrenic members

Matthijs Koopmans , MKoopmans@aol.com

The family process models that were developed in the nineteen fifties by Gregory Bateson and coworkers, and Theodore Lidz and coworkers argued that the onset of schizophrenic symptoms was at least in part attributable to dysfunctional interaction in the nuclear family. While this work had a great impact among clinical practitioners, research failed to establish the hypothesized patterns of interaction. An alternative model was developed in the early to mid-nineteen-sixties, which distinguished families who had high degrees of emotional overinvolvement (EOI) in their interaction from those with lower levels of EOI. There is an extensive literature indicating that if schizophrenic patients, who are hospitalized are returned to families who interact with high levels of EOI, are more likely to relapse than those patients who returned to families with lower EOI. In this presentation, I will look at a few specific examples of families rated as having high levels of EOI. Based on those examples, I will argue that in many of the typical depictions of high EOI provided in the literature, n-bind indicators tend to occur while there are no n-bind indicators in the descriptions of families with lower levels of EOI. This difference in clinical appearance allows us to hypothesize that EOI, a well-established predictor of the course of schizophrenic illnesses, may be a proxy of n-bind interactions. Conflicting attractors and the associated turbulence in the family yields high ratings on the EOI scale, whereas the absence of such indicators is rated as the manifestation of low emotional EOI. If this impression is confirmed empirically, it would appear that n-bind is an underlying mechanism to the levels of emotional overinvolvement detected in the families of schizophrenic patients.

Mathematics SAT, 0900, B

On the coding of information with finite pseudorandom sequences: Its measures and their interpretation

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M.A. Reigosa-Pardavila, O. Diez-Martinez, J.M. Trejo-Vargas, University of the Americas - Puebla

We consider different measures to characterize finite objects, encoded by finite sequences under a given alphabet, called strings. These measures, coming from information and algorithmic complexity theories, aloud us to differentiate between strings which codify a given data set (digitized neural-spikes, DNA and protein sequences, etc.) and sequences generated by pseudorandom generators. Among the measures of the first kind, we employ n-gram entropies, conditional entropies and diversity of the entropy. Among the ones of the second kind we use context-free grammatical complexity, algorithmic redundancy and algorithmic distance. To test different null hypothesis, we employ surrogate sets that share selected statistical properties with the string under study. We illustrate the usefulness of the approach with examples taken from neuroscience and molecular biology.

Physiology SAT, 1000, A

Applying non-linear models to the design of 'intelligent' hearing aids

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Listening to speech when it is embedded in background noise is a particular problem for people with inner-ear hearing impairments. Normal amplifying hearing aids amplify the background noise as much as the speech signal, which actually makes speech perception even more difficult because of the complicated way in which the frequency resolution of the ear changes with the intensity of the sounds being heard. Work is described in which artificial neural networks are first trained with real speech signals and then used to clean up speech that is obscured by noise. Different approaches are compared, including a system in which the network acts as a controller, continuously altering a series of filters to best remove background noise whilst leaving the speech intact. It is shown that such processing significantly improves the intelligibility of speech. These studies demonstrate how the ability of adaptive non-linear models to extract generalities from real-world data and then apply this learning to the solution of problems in situations of imprecision and continual variation can be of considerable use in a real-life situation.

Mathematics SAT, 0920, B

Trigonometric Chaos and Bios

Hector Sabelli, Chicago Center for Creative Development, hsabelli@rush.edu

Feedback usually is bipolar (positive and negative) in natural processes. Bipolar feedback can generate bios, a chaotic process that diversifies in time rather than converging to an attractor. Heartbeat intervals series and other empirical processes show biotic patterns [Sabelli and Kauffman, Cybernetics and Systems, 1999]. The generation of chaos and bios by bipolar feedback is here explored by comparing a number of recursions of trigonometric functions. The process equation At+1 = At + k * t * sin(At) generates a bifurcation cascade (with a prominent unifurcation, a shift that looks like a bifurcation minus a leg), 2N periods, chaos (with sudden expansion, and prominent period 4), and bios [Kauffman and Sabelli, Cybernetics and Systems, 1998]. The recursion At+1 = At + sin(At*(k*t)) generates a similar sequence of periodic, chaotic, and biotic patterns although there is no increase in the feedback gain. The same patterns obtain with the recursion of cos(At). In contrast, recursions such as At+1 = k * t * sin(At) and At+1 = k * t * sin(At*(k * t)) generate chaos (but not bios) displaying two opposite sinusoidal bands. Further, the recursions At+1 = At + k * t * cos(At) and At+1 = At + cos(At*(k * t)) generate a logistic-like bifurcation cascade (without unifurcation or expansion, and with a prominent period 3); the chaotic phase is organized by bands corresponding to the cosine and its harmonics. These studies point to the conditions required for the production of chaos and of bios. The production of complex pattern by bipolar feedback, and the differences between sine and cosine feedback, highlight the role of opposites in the creation of complexity.

Symposium SAT, 1000-1100, C

Archetypes and Dynamics within a Unitary Reality

Bill Sulis, McMaster University
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Robin Robertson

In "On the Nature of the Psyche", Jung commented that "since psyche and matter are contained in one and the same world, and moreover are in continuous contact with one another and ultimately rest on irrepresentable, transcendental factors, it is not only possible, but fairly probable, even, that matter and psyche are two aspects of one and the same thing." While Jung did a great deal to explore and describe the structure and dynamics of this unus mundus (unified world), he lacked modern non-linear dynamic concepts. In this symposium, we will discuss some ways that archetypal psychology and dynamics complement each other and together begin to describe such a unitary reality.

Physiology SAT, 1020, A

Is Chaos Still Good for You? - Goldberger's hypothesis revisited

Dick Bird, University of Northumbria
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Goldberger and his co-workers have proposed, in the context of the heart, the hypothesis that "Chaos is good for you". Since that time this hypothesis has been challenged, not least because of the absence of evidence for chaos in the heart. Despite evidence that chaos is widespread in nature doubts have also been raised about its presence in many other biological systems. Here the view is widened to climatological, financial, mechanical and other kinds of system. There is a clear overall message from many different areas which suggests that the more stable or more adaptive systems are the ones with comparatively lower-dimensional chaotic dynamics. While it is often hard for a number of reasons to establish hypotheses in biological science, this wider view makes Goldberger's original proposal seem plausible. Reasons for failure to detect chaos in some biological systems are considered and a concept of chaostability is proposed which might replace that of homeostasis in the regulation of biological systems.

Mathematics SAT, 1000, B

Simulations of an agent-based model that consists of a large number of agents moving stochastically in a wide bounded domain

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Akira Ide, Kyushu Tokai University, Nobuoki Eshima, Oita Medical U. Ichiro Takagi, Kyushu Tokai U., Yasuhiro Takei, Osaka U., Michiko Yasukawa, Kyoto U.

Consider an agent-based model that consists of a finite number of agents which stochastically move within a bounded discrete domain to obtain higher utility. We assume that both imitative processes and avoidance processes work in their moving, i.e., that the utility is a concave function which attains its maximum when the density of agents is equal to a certain positive constant. We assume that the cost incurred in moving from one point to another point is identically equal to a positive constant or to a linear function of the distance between the points. The agent-based model can describe, e.g., interregional migration in quantitative sociodynamics. If the number of agents is extremely large and the domain is very wide, then it is almost impossible to investigate the model only by doing numerical simulations. In order to overcome the difficulty, we employ a deterministic continuous model to which the model converges in probability as the number of agents converge to infinity, the size of agents 0, and the least unit of discrete space variable 0. The continuous model thus derived can more clearly describe the macroscopic behavior of agents than the agent-based model itself. Taking a numerical-analytic and functional-analytic approach, we deduce that the continuous model exhibits self-organization, has an infinite number of stable equilibria and an infinite number of unstable equilibria, and converges to a stable equilibrium as the time variable increases.

Physiology SAT, 1040, A

The significance of Information for the development of healthy or Ill states

Karl Toifl, University of Vienna
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The significance of various aspects of information, based on a clinically tested definition of "healthy" and "ill" derived from chaos theory and self-organization, is described and discussed, especially with regard to the creative effect it has on energy in the human system. Health and illness are seen as qualitative states which exist at all functional levels of the biopsychosocial entirety of the human system, and which are subject to constant change. The state of illness is more likely when strategies for coping with demands and problems are relatively few in number, and relatively rigid or lacking regarding the best way of solving problems. The state of health is much more probable when there is a great deal of variety in the strategies available, and if they are as flexible and purposeful as possible. The qualitative state, however, is dependent on the extent of the demands that each system is faced with. For the emergence of such states, not only the genetically coded information, for instance, but also a variety of information from the psychosocial area is necessary to initiate and maintain self-organization. Depending on the quality and quantity of the information, different qualitative states are produced in the system. The best way to make use of this abundance of information diagnostically is through the parallel, simultaneously integrating use of three different, theoretically-based points of view (biologically, depth-psychologically and systemically oriented), so as to obtain a comprehensible diagnostic mosaic. Taking this as a basis, therapy may, for example, include an attempt to go beyond the information already compiled, to re-structure it or to change it along the way by adding new information, in order that a healthier state may come about.

Mathematics SAT, 1020, B

Diversification, equilibration, and embedding correlation: three new statistical methods to identify creative biotic patterns in empirical processes.

Hector Sabelli, Chicago Center for Creative Development, hsabelli@rush.edu
Minu Patel, University of Illinois at Chicago

Many natural processes (such as psycho-biological and economic time series) are spontaneously creative, rather than converging to pre-existing equilibrium, cyclic or chaotic attractors. Three new statistical methods serve to characterize such creative processes, to demonstrate

their similarity to bios generated by bipolar feedback, and to differentiate them from chaos. In order to identify evolving processes, we measure temporal changes in statistical parameters by measuring changes with embedding, duration of sample, or across epochs. Diversification (temporal changes in variance) differentiate three types of processes: (1) mechanical and random processes that maintain their phase space volume; (2) processes that shrink to an equilibrium, cyclic or chaotic attractor; (3) creative processes that expand their phase volume, such as biological data, economic series, random walks, and bios. Equilibration (changes in asymmetry, measured as skewness for normal distributions, and as the difference between median and middle of the range for non-normal distributions) shows a significant asymmetry that decreases with embedding for empirical series, random walks, and mathematical bios, while chaotic and random data are symmetric. Embedding correlation (correlation of sets of consecutive members of a series) shows autocorrelation (undetected by standard techniques) for the differences between consecutive terms of biological, economic, and biotic series. Diversification, asymmetry, equilibration, and correlation between successive changes, as well as novelty and nonrandom complexity are characteristics that may be expected in creative processes. They are observed in psychobiological and economic processes as well as in mathematical bios, but not in chaotic attractors or in random series.

Physiology SAT, 1100,A

Applications of Difference Equations in Mathematical Biology

Michael Raden, Rochester Inst. Of Tech.
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On the Population Model x_{n+1} = a + b x_{n-1} e^{-x_{n}} , n = 0, 1, 2, ... where a and b are positiove real numbers. We will investigate the above population model and see how the long term dynamics depends on the relationship between the two parameters a and b. We will also discuss the extensions of the above model, previous population models, and the important role difference equations play in mathematical biology.

Mathematics SAT, 1040, B

Functional Differentiation in EVS models

Irina Trofimova, McMaster University
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Functional Differentiation model was developed within Ensembles with Variable Structure (EVS) approach. EVS-approach represents interacting populations of cells with an exchange of resource and a diversity of cells, where they seek to form connections with other cells according to these characteristics. Model studied a role of cell's individual thresholds of operating a resource and a role of cell's individual sociability in functional differentiation among agents. Ratio between some types of agents was found.

Plenary, 1100-1200

CLINT SPROTT

Dr. Sprott is a Physics Professor at University of Wisconsin-Madison,author of the "Chaos Data Analyzer" software, and an expert at visualization of complex systems. He will be discussing "Can a Monkey with a Computer Create Art?

While studying chaotic dynamical systems, I inadvertently generated a few million fractal images, called strange attractors. These images were selected by the computer from among a few billion cases that were analyzed. I showed a few thousand of these to about a dozen artists and scientists who evaluated them aesthetically. From that I discovered a strong correlation between their aesthetic quality and mathematical properties such as fractal dimension and Lyapunov exponent. Then I was able to train the computer to be even more selective and to produce thousands of images, all different, and most which are aesthetically appealing. I will describe the process and show examples of the images produced in this way and will even produce some new ones during the talk.

Sociology SAT, 1320, A

Ups and downs: A dynamical systems model of human affective fluctuations

Keith Warren, The Ohio State University
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Julien C. Sprott, University of Wisconsin

Studies of subjective well being often result in counterintuitive findings. For instance, studies of subjective well being have shown that it has little to do with life circumstance. The subjective well being of individuals with severe disabilities is little different from those without such disabilities (Diener & Diener, 1996), while even small events in the immediate past can alter an individual's estimate of his or her subjective well being (Kahneman, Diener & Schwartz, 1999). In this paper we will link these empirical findings to a simple mathematical model, in which individuals react to the changes in affect-ups and downs-rather than their "objective" external state. Others, on the other hand, see our overall state, noting such variables as our income and socio-economic status. We place this model in the form of a simple mathematical equation, in which we see the first derivative of a function describing our condition, while others see the function itself. While the model is related to those of Carver and Scheier (1999) and Hsee and Abelson (1992), in which individuals monitor their rate of progress toward a goal, we link these ideas both to subjective well-being and to systematic differences in understanding between observers and those observed. This model helps to explain the remarkable resiliency of human subjective well-being because short-term changes are likely to include both increases and decreases regardless of one's overall external situation; thus, that situation will have little impact on one's subjective well being. This

presentation will include empirical evidence in support of this theory, drawn from time series analysis and from previous studies. It will also, in line with the theme of the conference, include computer-generated graphical illustrations of the implications of this theory.

Ecology SAT, 1300, B

Self-organization of landscape patterning

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Self-organization is a process of evolution where complex structures emerge from a random disordered initial state through repeated application of simple rules. By altering the rules and comparing the resulting patterns with those observed in nature, it is possible to test hypotheses about environmentally driven evolution in natural processes such as landscape pattern formation. In this paper, a stochastic, two-dimensional cellular automaton with periodic boundary conditions was applied to a landscape pattern from southern Wisconsin prior to Euro-American settlement, consisting of general topological features such as prairies, savannas, open forests, and closed forests. The cellular automaton evolves using one simple rule: At each time step, the content of each cell is replaced by one chosen randomly from some neighborhood of radius r. This single-parameter model gives realistic time-varying landscapes for values near r = 5 km. The increase in organization can be measured by the statistical distribution of cluster sizes and the fractal dimension of the patterns. These topological properties are found to be independent of initial conditions and compare well with the same quantities calculated for the natural landscape. The results suggest that the simple rule suffices to explain major statistical and spatial characteristics of the observed landscape.

Symposium: SAT, 1300-1420, C

Neurocognitive Synchronization

Fred Abraham--facilitator

Spatial patterns of phase in the gamma EEG reveal episodes of fixed nonzero phase distributions recurring in the theta range

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Simultaneously recorded EEGs from 64-channel electrode arrays on visual, auditory, or somatic cortices and olfactory bulb of rabbit brains have spatially coherent oscillations constituting a common carrier wave. Identifiable spatial patterns of amplitude modulation (AM) in brief segments of the coherent wave form recur with presentations of conditioned stimuli. The 64 EEG traces seem to be synchronous, but they are not. Selected segments have a phase cone with a gradient matching the conduction velocities of axons parallel to the pia. Modal diameter is 10 - 15 mm; modal duration is 75 - 101 ms. Phase cones appear to be lacking just after times of stimulus arrival but recur in pre- and post-stimulus epochs at rates in the theta range (2-7 Hz). The spatial AM patterns reveal perceptual constructs formed by nonlinear cortical 1st order state transitions. Because the sign of phase at the apex varies randomly between maximal lead and lag in successive cones, we infer that the apex of each cone marks the site of nucleation, not a pacemaker. From the phase cone we can estimate the size, location, duration, and recurrence rate of perceptual constructs. The results support a dynamic solution to the 'binding problem, by which the activities of 'feature detector' neurons are integrated into percepts in the sensory cortices, in which learned amplitude optimization compensates for nonzero phase distributions of summed signals in the gamma range. In brief, AM patterns give the cognitive content of the wave packets; the phase patterns show how they form and how often.

Ultradian rhythms and control of chaos

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Short biologic endogenous rhythms, called ultradian, are scaling fractals, adapting to stress with changes in amplitude, frequency and period as they entrain (couple) to each other and to the environment. These changes are observable on both microscopic (single cell recording) and macroscopic (sleep rhythms, social rhythms) scales. Entrainment of ultradian rhythms is important in attachment and attunement behaviors as well as in the long-term effects of neglect and abuse. These concepts are discussed as they relate to synchronization and control of non-linear chaotic systems.

From pendulum clocks to chaos theory: introducing control and synchronization, review and examples.

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Studying isolated and interacting systems. Brief introduction on the history of synchronization and control studies from Huygens to chaos theory. Review of synchronization for harmonic oscillators to chaotic oscillators and harmonic oscillators in a noisy environment. Typologies of coupling and synchronization in chaotic systems : weak, strong, punctuated. Transitions and the resulting attractors. Use of forced synchronization for control. Some control methods: Ott-Grebogi-Yorke method, Pyragas method, Pecora-Carrol method. Possible applications in psychology and the life sciences. Modeling synchronization in human relations. Examples from conversation dynamics: 1) symbolic-analogic; 2) informational.

New media, learning and synchronization

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New media (hypertexts, multimedia, hypermedia and the Internet) are strongly modifying teaching and learning. The aim of this presentation is to show how it can happen. Several applications and examples on: 1) learning with hypertexts and hypermedia (the teacher is present, synchronous communication);
2) learning with hypertexts and hypermedia (the teacher is not present, asynchronous communication).

Sociology SAT, 1340, A

The Many Facets of the Holy Grail

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We will examine a pattern that predominates in many cultures: the sacred cup. The predominant pattern as well as a number of variations will be explored across many cultures, places, and times. We will explore links that suggest a dynamic attractor in collective consciousness.

Sociology SAT, 1300, A

A fractal investigation of physical factors in human settlement behavior

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Fractal methods were used to examine the relative importance of social and physical relief factors in settlement behavior. The settlement patterns around a number of US cities are compared using an estimate of clustering (mass dimension) and an estimate of ruggedness of terrain (standard deviation of elevation). The data was analyzed to discern if there was any correlation between clustering and ruggedness, and whether low dimension patterns had significantly different ruggedness to high dimension patterns. Although significant differences in ruggedness were found between low and high dimension patterns ($df=19, t=1.83, p<0.05$), only a weak negative correlation (-0.37) was found between dimension and ruggedness. This would indicate that while settlements in flatter areas seem to be less clustered, ruggedness of terrain cannot adequately explain settlement patterns. This implies that social, psychological and / or economic factors play more of a role in choosing settlement locations than do purely physical ones.

Ecology SAT, 1340, B

Swarmsara: An Artificial Life Approach to Buddhist Land Resource Management

Alex Turner, University of Wisconsin-Madison, alturner@execpc.com

Swarmsara is an artificial life simulation based on Buddhist theory and Swarm. It explores the interaction of emotional distortions of perception with cause and effect. Future applications might include simulation of the emergence of cooperation and spatial land resource modeling.

Sociology SAT, 1400, A

Chaotic Components in Arts and Architecture

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Chaos theory is the study of complex non linear dynamic systems and it has a connections with the fractal geometry. Chaotic systems have the appearance of unpredictability but are actually determined by precise deterministic laws. Chaotic systems show major fluctuations for apparently minor changes in the parameters which control them. The aim of this paper is to present some relationships between arts, architecture, and chaos theory. In fact, it is easy to find the golden ratio, the symmetry, the tasselations, the Fibonacci's sequence in architecture and arts, but it is unusual to find some relations between the arts and the chaos. In arts many paintings have recurring shapes (e.g. spirals and vortices), that can be explained using the chaos theory, too. For example some rock engravings (6000 B. C.), found in a cave at Djerat near Tassili-n Ajjer in the South of Algeria, show some chaotic shapes. We can also find in ancient arts (Greek art, Roman art) some S-shaped and spirals that the science now explains using the chaos theory. The spiral patterns symbolise activities in the life-giving boundary between order and chaos. Anthropoligists say the spiral is the ancient symbol for the labyrinth, the twisted pathway for a journey to the core of being. We have organised the paper in two different parts: (a) The chaotic components in arts (e.g. the analyses of some da Vinci's or Van Gogh paintings) , (b) The chaotic components architecture (e.g. in the research of some strange attractors inside a plan).

Economics SAT, 1500, B

Econophonia: A Sound Economic Analysis

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On the cusp of a new understanding of perception and cognition processes, this paper relates experimental economics, cognitive psychology, and the study of complex dynamical systems. Undergraduate subjects are tested on their ability to predict the trajectories of nonlinear systems. The output data of nonlinear systems are presented to the subjects, measuring their relative success in perceiving and projecting in different sensory modalities the trajectories of these nonlinear systems (some of which are chaotic attractors). Experimental data demonstrate the relative efficacy of perception and projection by subjects in graphical, textual, and "sonified" modes. I explore applications of

these findings in understanding nonlinear behavior in economic systems.

Sociology SAT, 1500, A

Further up the Holler: The Fractal Nature of the Internalized Hillbilly Stereotype

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This paper approaches the relationship of stereotype-holder to stereotyped individual as a boundary condition. Previous research has focused on stereotypes as promoters of target group homogeneity - but offered minimal insight into the impact of stereotyping on patterns of self-identification within the target group. Often there is considerable similarity between the stereotype and aspects of the target group's perceptions of its own group members. This similarity is a function of a recursive othering process that results from both the internalization of the stereotype and group members' expertise at making minute intragroup status differentiations. The nature of internalized stereotyping is such that a fractal boundary exists between the holder of the internalized stereotype and the perceived exemplar of that stereotype. Research on the "Hillbilly" stereotype illustrates this phenomenon. Appalachians have lamented and railed against this stereotype for generations - but have internalized it so that, at the individual level, it is persistently applied to others based on constantly refined socioeconomic and geographic distinctions. A search for the "true Hillbilly" reveals increasingly subtle detail used by holders of the internalized stereotype to affirm the stereotypes "accuracy" while distancing themselves from the "proper" target of its application. The fractal nature of internalized stereotypes contributes to their temporal and cultural stability and partly explains their continued persistence. This has implications for both researchers into sociocultural phenomena and social change advocates.

Economics SAT, 1520, B

The Great Depression: Computer Simulation of a Complex Catastrophic Event

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The Great Depression in the United States must rank as one of the most complex and catastrophic events in the 20th century. National Income fell by 37% from 1929-1934. Almost every sector of society (economic, demographic and political) played some role in the event. How might we handle the full complexity of this event while allowing a role for cybernetics, catastrophe theory, chaos theory and complexity theory? I present results from the USGDSIM model which is based on the Bertalanffy equation system and allows roles for complex nonlinear dynamics, cybernetics and political "forcing functions." The USGDSIM model decomposes early 20th Century US development into sustainable growth paths, demographic-economic long swings and government policy initiatives. Simulation results suggest that the 1920s boom period was the upside of a demographic-economic cycle. The gradual return to a sustainable growth path during the 1930s was accelerated by government policy blunders.

Symposium: SAT, 1500-1640, C

State space analysis of a socioemotional transition at 18-20 months

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Discontinuities or transitions in socioemotional development are thought to indicate underlying reorganizations. From a DS perspective, developmental transitions are phase transitions -- global reorganizations in the patterns of interaction among the elements of a developing system -- and they should be indicated by a period of fluctuation or instability sandwiched between more stable epochs. We investigated a socioemotional transition hypothesized to occur in the middle of the second year (18-20 months). On 12 monthly visits from 14 to 25 months, we videotaped infants' behavioral adaptations to two frustrating events while their mothers sat nearby without helping. Behaviour was coded on two ordinal scales representing five levels of engagement with the toy and five levels of engagement with the mother. State space grids were constructed for each episode by plotting the second-by-second values of the two scales on a 5x5 grid of cells. To determine grid-to-grid stability over age, all grids were entered into a cluster analysis. Grids with the same cluster scores were alike topographically. An ordinal variable, homogeneity, was defined as the degree of similarity in cluster scores across months. Homogeneity for both tasks showed the predicted profile, starting high, dropping in the middle months, and then returning to a high continuous level. Using a curve-estimation procedure, the quadratic component of the curve (high-low-high) was significant for one task and a trend for the other, with the estimated curve reaching its lowest point at 19 months for both. These findings indicated a period of developmental reorganization in socioemotional functioning at the hypothesized age.

Deviancy training as an attractor: Concurrent and predictive validity

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Antisocial youth engage in a process of deviancy training in which positive affective exchanges organize reciprocal deviant talk (e.g., talk about stealing, lying). This pattern predicts escalations in drug use, delinquency and violence (Dishion et al, 1995, 1996,1997). Past studies measured deviancy training by the mean duration of rule-breaking bouts. But a measure of central tendency

does not suggest a mechanism that links real-time processes to antisocial developmental outcomes. We have begun to conceptualize deviancy training as an attractor which functions as an absorbing state for antisocial peers. The current study examined a subsample of adolescents and their best friends who were videotaped problem solving for 30 minutes. Two groups were compared: a nonclinical (NC) and an externalizing group (EXT; e.g., aggressive, delinquent). Rule-breaking and normative talk were coded continuously from the videotapes. It was expected that over the course of the interaction, EXT, but not NC, peers would spend increasingly more time in a state of reciprocal rule-breaking talk. A time series representing the duration of successive bouts of rule-breaking talk was created for each dyad, and phase plots were derived. The plots showed that bout duration increased over time for EXT but not NC youth. To quantify these impressions and examine their predictive validity, slope values were derived from the time series and entered into two logistic regressions to predict concurrent and future clinical status. As hypothesized, for the analysis of the concurrent measures, slope values significantly differentiated the EXT and NC group, with the EXT group showing a positive and the NC a negative slope profile. More importantly, the slope profiles significantly predicted clinical group status two years later.

Depiction of Dynamic Patterns in Self-Organized Group Formation using Vector Fields and Phase Portraits

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When formerly unacquainted people self- organize into groups, they create new structure at the group level and at the level of the larger social network that contains both emergent groups and isolates. Dynamic patterns of continuity and change at these two levels were examined for 30 sets of 8 people who repeatedly formed groups as part of a social card game. Network analysis measures of change over time, such as the QAP correlation, indicated that some of the miniature "societies" settled into a stable set of groups and isolates, but most did not. At the society level, the dynamics indicated an increasing trend away from isolates and toward full inclusion of all members in groups. Transition probabilities were used to construct vector fields that illustrate how the patterns of group size differ when these developing "societies" were perturbed either early in the process of self-organization or later on. Phase portraits illustrate qualitative differences in trajectories for different societies. The perturbation was a change in the payoff structure for the game. Contrary to expectations, changes in societal configuration were not coordinated with external perturbations, although changes in group composition were. Questionnaire data revealed that endogenous change in the social organization occurred when individual dissatisfaction was communicated and reinforced at the dyad or group level.

Using State Space Grids to Depict Phase Transitions in Adolescent Development

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A basic tenet of developmental stage theories has been that development is characterized by a number of discontinuous, abrupt shifts. The current paper reports on a study designed to examine the structural differences in adolescent boys' behavior before, during and after one of these critical periods, puberty. We hypothesized these changes would exhibit the characteristics of a phase transition - behavior both before and after puberty would be relatively stable but, during the transition period, behavior would become less stable and more variable. We tested this hypothesis on 61 boys and their mothers participating in the Oregon Youth Study using real-time observations of their problem-solving discussions videotaped once every other year between the ages of 10 and 18. We created state space grids for each dyad at each wave. These grids are plots of behavior in real time with each subject on separate axes such that a point represents a dyadic turn and, when the dyad's behavior changes, a new point is plotted and line connects them. Using the number of unique cells in the state space visited per unit time as our dependent measure, we found a significant quadratic trend, maximum variability during puberty (age 13-14). Implications of these results for both normative and non-normative development are discussed.

Sociology SAT, 1520, A

A New Approach to Nonlinear Decision Function of Social Process: Professor Helbing's Decision Theoretical Specification

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The idea of utility function by itself is too poor to contribute into social decision theory. Social decision function and welfare function of traditional economics should be replaced with a new analytical form. Social interaction of agents is a process of mutual influence for better or worse. Utility of each agent is always affected not only by others' behavior but also by subgroups' characteristics to which each belongs. Decisions in many cases evolve as a result of nonlinear aggregate dynamics, which can be expressed in terms of master equation, as long as the variables in a system are a few. The key issue to achieve this hinges on the definition of the transition rate." Social dynamics of Weidlich and Haag(1983), in other words, social synergetics is a pioneering work in this sense. Recently, Helbing(1995, pp.132-137) skillfully in this context was successful to define an analytical form of decision of social interaction. Helbing has an insight that utility has a past history of decision sequence and also cannot be independent from it. His utility function should rather be called a psychologically complex value. Consequently, utility will fluctuate like in human mind. He specified the elements

like flexibility, distance and effort, attractiveness for decision by a subgroup to define readiness of decision. Thus the social transition rate for a subgroup could be foumulated. Such a social transition rate will be operated in the master equation of social process. Incidentally, this transition rate may be applicable to the Avatamsaka game process given by Aruka(2000) and Aruka(ed.)(2001).

Economics SAT, 1540, B

Multiple Unofficial Economy Equilibria and Income Distribution Dynamics in Transition Economies

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Ehsan Ahmed, Economics

Large increases in the relative size of unofficial economies in many transition economies arise from a dynamic interaction with rising income inequality and public sector changes in multiple equilibria systems. Returns to unofficial activity are first increasing and then decreasing, implying two distinct stable equilibria, with changes in inequality possibly causing a jump from one to the other quite suddenly. Multiple regressions of data from 17 transition economies find income inequality strongly associated with the relative size of the unofficial economy and also increases in income inequality with increases in the relative size of the unoffical economy. Other significant variables positively associated with the unofficial economy include the maximum annual rate of inflation, the effective marginal rate of capital taxation, and an index of economic freedom.

Sociology SAT, 1540, A

Avatamsaka Game Experiment as a Nonlinear Polya Urn Process

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Avatamsaka Game appearing in Aruka (2000) and Aruka (ed.) (2001) which describe a social dilemma appearing when we assign such a pay-off structure that (defect, defect) = (0, 0), (cooperation, defect) = (0, 1), (defect, cooperation) = (1, 0), (cooperation, cooperation) = (1, 1). The interesting feature of this game appears in that cooperative players cannot necessarily be guaranteed their own gains by their behavior. This game experiment has been undertaken in Tokyo, Milwaukee, and Frankfurt am Main. The results of successive experiments on the web specifically in cooperation with Stephen J. Gaustello at present are giving some new insights on human behavior. In order to analyze these, we need a theoretical hypothesis of path dependency on each player's strategy policy. In order to do this, the author suggests the use of nonlinear Polya urn process, which was rediscovered by Arthur(1994) , a Santa Fe economist, as a main force of path dependency.

Economics SAT, 1600, B

Let It Be; Chaotic Price Dynamics can be Beneficial

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The main purpose of this study is to address the question of whether consumers can benefit chaotic price instability. This question was raised by Wough [1944, Quarterly Journal of Economics 58, 602-614] more than a half decade ago, and a positive answer was given only under a very limited circumstance. The same question is reconsidered in this study with a help of the recently-developing nonlinear dynamic theory. To this end, we study price adjustment in a disequilibrium model in which trade occurs at disequilibrium prices. To make such an analysis possible, we formulate a consistent adjustment model that takes disequilibrium phenomena into account and organize the study as follows: (1) we outline a basic pure exchange economy and then show to constitute the logistic map as a dynamic system of the model; (2) we analytically demonstrate that the long-run average utilities taken on chaotic paths can be preferred to a stationary utility (i.e., a utility taken at a stationary state) under specific parameters' values; (4) to confirm and complement the theoretical result, we perform some numerical simulations that give rise to the same results. The main result of this study, namely, chaotic price dynamics can be beneficial to consumers, will shed light on the nature of long-run irregular dynamics that has been neglected in the traditional economics.

Economics SAT, 1620, B

Control of Hyperchaos in an OLG Economic Model

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Diana A. Mendes

This paper deals with the control of chaotic economic motion. We show that very complicated dynamics arising, i.e., from an overlapping generations model (OLG) with production and an endogenous intertemporal decision between labour and leisure, which produces hyperchaos (both eigenvalues with values higher than unity), can in fact be controlled with relative simplicity. The aperiodic and very complicated motion that stems from this model can be subject to control by small perturbations in its parameters and turned into a stable steady state or into a regular cycle. We apply the pole-placement technique, developed by Romeiras, Grebogi, Ott and Dayawansa (1992), to control the chaotic dynamics of this economic model. The application of control methods to chaotic economic dynamics may raise serious reservations, at least on mathematical and logical grounds, to some recent views on economics which have argued that economic policy becomes useless in the presence of chaotic motion (and thus, that the performance of the economic system cannot be improved by public intervention, i.e., that the amplitude of cycles can not be controled or reduced). In fact, the

fine tuning of the system, or its control through an external force, can be performed without having to rely only on infinitesimal accuracy in the perturbation to the economic system, as the control can be performed within a relatively large (but not too large) subset of the linearized parameter space.

SAT 1800- 'til Social Hour and Banquet featuring

STEPHEN GUASTELLO

Dr. Guastello is one of the earliest members of the Society, Editor of our journal Nonlinear Dynamics, Psychology, & Life Sciences,and a leading expert on catastrophe theory. He will be discussing "20 years of Nonlinear Dynamics in Organizations"

The year 2001 marks the 20th anniversary of the first journal article where principles of nonlinear dynamics were applied to phenomena in organizational psychology. This presentation highlights the landmarks in theories of organizational development, work motivation and personnel selection, creativity, coordination in work teams, leadership emergence, work performance in hierarchies, and strategic management. The accuracy associated with empirical results supporting nonlinear theories is approximately double the accuracy associated with linear theories. Together we will explore the ever-growing frontiers of nonlinear dynamics applications.

SUNDAY, AUGUST 5

Cognitive Psychology SUN, 0820, A

Multilevel Webs As Non-Deterministic Complex Systems

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As soon as we reach a certain threshold of complexity, in synergetic systems, events and outcomes are no more following a deterministic course, even nonlinear deterministic bifurcations. Multilevel webs are systems that 1) exhibit internal multiplicity in organizational levels, and 2) show cooperative interactions and inter-influences between connected networks/processes, within and across levels, so complex that they render determinism irrelevant as a formalism. An example of such multilevel web, in which various forces or subsystems interact simultaneously within and across levels, is the human mind: in the mind-body-psyche system (MBP-system), sensations interact and co-evolve with thoughts and feelings, and all these processes are themselves linked to neuronal networks. If local deterministic dynamics may be extracted (e.g. drinking alcohol will induce such and such somatic and neuronal changes), non-deterministic inter-influences are the most pervasive dynamics in the MBP-system. For example, an individual may use the drunk state in a variety of ways, e.g. to be artistically creative, and their subsequent creation will be undetermined. Mind dynamics such as intention, will, creativity, innovation, feelings, artistic sense, sense of humor, sense of beauty, and peak experiences, are fundamentally non-deterministic. They are web dynamics that imply creative emergence, based on complex inter-influences between multiple levels in the MBP-system, as well as inter-influences between these and surrounding webs¾such as other people, organizations, society at large, and environmental webs. Thus cognitive multilevel webs demonstrate creative self-organization and free-will.

Cognitive Psychology SUN, 0840, A

Mapping the Unpredictable: the Dynamical Nature of Mood and Emotion

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The non-linear, dynamical nature of mood and emotion is explored, first phylogenetically and then as it appears in healthy and pathological states, under conditions of both normal and abnormal stress. A scale-invariant (fractal) measure of mood and emotional state appears to be the biological rhythm known as ultradian. Ultradian rhythms are endogenous biological oscillations shorter than 24 hours in duration. Examples of this fractal measure may provide information as to the unfolding of the stress response syndrome, Posttraumatic Stress Disorder. Posttraumatic Stress Disorder has been characterized by catastrophic alterations in mood and emotional state that appear to be triggered by small environmental cues. Other human conditions such as aging, or persistent pathological states such as those found in Bipolar Disorder or Alzheimer's Disease may be understood as dysregulations of ultradian rhythms to the circadian cycle. These conditions show a loss of complexity of integrated function that is measurable using non-linear tools. We know that pathological environments can change the brain in enduring ways, constricting both the range and intensity of emotional expression. Successful treatment of psychiatric illness, by whatever method, returns emotional responsiveness to physiological norms. Healthy states of mood and emotion provide maximum flexibility in adaptation to changing conditions, while the aging brain is restricted to unmodulated and inflexible responses to new conditions, thereby limiting adaptation. The evolution in complexity of brain organization is responsible for the emergent system of mood and emotion. Ultradian rhythms, as fractal measures of mood and emotional state may prove useful in both diagnosis and treatment of psychiatric conditions.

Communication SUN, 0820, B

Modeling High-Resolution Broadband Discourse in Complex Adaptive Systems

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Numerous researchers and practitioners have turned to complexity science in order to better understand human systems. Simulation is commonly used to observe how the micro-level actions of many human agents create emergent structures and novel behavior in complex adaptive systems. In such simulations, communication between human agents is often modeled simply as message passing, where a message or text may transfer data, trigger action or inform context. Human communication involves more than the transmission of texts and messages, however. Such a perspective is likely to limit the effectiveness and insight that we can gain from simulations, and complexity science itself. In this paper we propose a model of how close analysis of discursive processes between individuals (high-resolution), that occur simultaneously across a human system (broadband), dynamically evolve. We propose six different processes that describe how evolutionary variation can occur in texts—recontextualization, pruning, chunking, merging, appropriation, and mutation. These process models can facilitate the simulation of high-resolution, broadband discourse processes, and can also aid in the analysis of data from such processes. Examples are used to illustrate each process. We make the tentative suggestion that discourse may evolve to the "edge of chaos". We conclude with a discussion concerning how high-resolution, broadband discourse data could actually be collected.

Cognitive Psychology SUN, 0900, A

Chaos Theory, Visualization And Psychogical Change

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This paper describes the relation of visualization to psychological and behavioral change. As a function of brain processing, the power of visualization, when understood and utilized can be formidable in healing and making positive changes in attitude, perspective and re-organizing internal states. The majority of people in our country use visualization as their preferred representational system.. That means that our brain uses visualization as the first filter in processing incoming information. Chaos theory postulates that depending on initial conditions, a small change can lead to very large changes. With visualization, small shifts, when appropriately applied, can lead to major and compelling changes in behavior and attitude. Tiny shifts may appear to be fractal, but they are not. Those slight modifications are indexes of a very different picture and are critical to the change process. Since our brain stores past experiences in memory, visualization can change our feelings about past experiences. Similarly it has the power to propel us into a compelling future, with appropriate visual shifts.. Minor adjustments can change a negative visualization into a positive one. Negative pictures often stimulate anticipatory anxiety or phobia behavior. Chaos theory leads to our understanding of many elements about how visualization works. We still do not understand why it should be such a powerful force for processing information in our brain.

Communication SUN, 0840, B

Human communication as complex system: a quantitative analysis

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Over 1000 research interviews made from students during their psychology university course have been analyzed. Our goal was to extract information on the evolution of a communicative process through simple quantitative measurements and with a particular attention to avoid any simplification form or classification. As in medicine blood analysis parameters can give an indication on the health state of a patient, our goal was to extract some measured indication on the "state" (correctness) of these psychological interviews. The whole interview process has been considered as a complex system evolving in the time. The nature intrinsically interactive of the dialogue concretizes, shapes and evolves within time dimension. A reciprocal adaptation, where each partner learns, step by step, to lead in the interlocutor's reference frame, without quitting its own, turns into a common system exceeding those of both fellow. During the interaction, the turn alternation is fundamental, specially when the mutual definition of the relationship involves the acknowledgement of different roles. Through word counting we estimated the conversation process time series from which we plotted the" phase-portrait". Some parameters defined as function of the phase portrait space occupancy give very good indication on the process evolution and on the observance of the psychological interview laws. This procedure allowed information extraction on the conversation evolution without any semantic analysis: plots with anomalous paths indicate situations where the communication has been troubled.

Cognitive Psychology SUN, 1000, A

Ordering, intelligence and entropy

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In a gas, sorting out randomly moving molecules so as to deliberately redirect their courses would imply the intervention of an intelligent actor: Maxwell's "demon".

Similarly, at a macroscopic level, retrieving randomly scattered elements (e.g. cardboard squares with a letter written on one side) and placing them in perfect order (namely on an alphabet) is a common way of developing a child's intelligence: the less groping the better, as opposed to a dumb machine which would try each possible position for each element until they match. However, even the intelligent player scans the model with his/her eyes before finding the right position for each element. All the worse if the alphabet is not in the normal order, as memorized for years in the player's brain. More generally, human performance results from two factors: actual "intelligence" based on understanding the logic of the model, and apparent "intelligence" which only consists in replacing mechanical groping with visual groping or scanning one's memory. Therefore, intelligence reduces the cost for decreasing entropy but does not zero it: in a partly assembled jigsaw puzzle, transferring a piece from the "chaos" to the already ordered subset requires several trials, whereas the opposite transfer only requires one move. This irreversibility suggests a thermodynamic analogy by considering the number of trials in the ordering process as the energy, be it mental required to decrease the entropy and "cool" the system. This "cooling" is obviously fictitious, but this analogy bridges a gap between statistical physics and the intelligence theory.

Communication SUN, 0900, B

Coupling dynamics of motion primitives in speech movements and its potential relevance for fluency

P.H.H.M. van Lieshout, University of Toronto
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This paper discusses a, for speech research, novel approach in which speech movements are treated as a complex sum of individual motions (primitives), generated by a self-organizing system of coupled neural oscillators. In this approach, the individual primitives are studied separately for their coupling dynamics as expressed in continuous estimates of relative phase. Using kinematic data from normal speakers and people who stutter under various task conditions, destabilizing influences to the coupling of dominant and non-dominant primitives are discussed with respect to their potential relevance to explain perturbing effects on speech fluency.

Cognitive Psychology SUN, 1020, A

Visualizing and Quantifying Nonlinear Dynamics in Human Cognition

Richard Heath, University of Sunderland, UK
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Alice Kelly & Andrew Heathcote, University of Newcastle, NSW, Australia

Human cognitive processes evolve over time and so offer a challenging medium for understanding complex dynamical systems. We examine how nonlinear visualisation and quantification technologies, originally devised by physicists, can be effectively employed to understand cognitive processes. These techniques include the use of third moment asymmetry to determine the presence of nonlinearity, the separation of stochastic and deterministic processes using noise-reduction methods; and the important issue of detecting nonstationarity using parametric and nonparametric techniques. These methods are illustrated using human response time data in n-choice tasks. Problems associated with psychological measurement and some possible solutions are highlighted.

Cognitive Psychology SUN, 1040, A

Memory across Eye-Movements: 1/f Dynamic in Visual Search

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Gregory Zelinsky, Department of Psychology, State University of New York
Julien C. Sprott, University of Wisconsin

The presence of apparently random behavior in visual search (e.g., Horowitz & Wolfe, 1998) has led to our proposal that the human oculomotor system may have subtle deterministic properties that underlie its complex behavior. We report the results of one subject's performance in a challenging search task in which 10,215 fixations were accumulated. A number of statistical and spectral tests revealed both fractal and 1/f structure. First, scaling properties emerged in differences across eye positions and their relative dispersion (SD/M), both decreasing over time. Fractal microstructure also emerged in an Iterated Function Systems test and delay plot. Power spectra obtained from the Fourier analysis of fixations produced brown (1/f2) noise and the spectra of differences across eye positions showed 1/f (pink) noise. While the sequence of absolute eye positions resembles a random walk, the differences in fixations reflect a longer-term dynamic of 1/f pink noise. These results suggest that memory across eye-movements may serve to facilitate our ability to select out useful information from the environment. The 1/f patterns in relative eye positions together with models of complex systems (e.g., Bak, Tang & Wiesenfeld, 1987) suggest that our oculomotor system may produce a complex and self-organizing search pattern providing maximum coverage with minimal effort.

Communication SUN, 1000, B

Multilevel model of creative thinking and the principles of CA simulation

N. Aniskovich, European Humanities University, naniskovich@mail.ru

We propose the multilevel model of creative thinking which is based on a dynamical systems approach to cognitive systems. The levels are the semantical level (or sense transformation level) or the level of logics and

grammar (in proposed model they are unified). Dynamical patterns are used as substitutions for representations in cognitive theories. The dynamics of each level, which is supposed to be chaotic, allows for the generation of new information not presented by initial conditions. In creative thinking consideration we use the results of some tests where the task of story generation from the schedule of some words is used. The normal strategy is considered when at first some general ideas relevant to story are generated and only then verbalization takes place. We suppose that two-levels model can be applied for cognitive simulation with CA as an example. Class 3 and 4 CA are considered as having properties essential for hierarchical systems functioning.

Cognitive Psychology SUN, 1100, A

Modeling dynamics of operant behavior controlled by fixed-interval (FI) schedules

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Joseph Huston, University of Düsseldorf

Considerable effort has been invested to model the functional mechanisms of operant behavior. Most of the this work has been devoted to the measurement of changes in behavior as a function of parameters defined in the reinforcement schedules, which usually predict averaged values of behavior across several sessions. Thus they were far from being equations of motion in the sense of Newton's classical dynamics, which dealt with real time behavior of systems. One possible reason for the rarity of studies in this direction might be the poor capability to analyze highly irregular time series data, the inter-response-time (IRT), from a typical operant experiment. Since the introduction of the Extended Return Map (ERM) last year, we have a better analyzing tool to extract information out of these complex data sets. In the present work, we built two models to simulate the IRT data from a Skinner-box experiment using fixed-interval (FI) reinforcement schedules. Both models reproduced frequency distributing curves of IRTs similar to the experimental data. They could also correctly reproduce the stereotypical scalloped curve shown in cumulative records of Skinner-box experiments controlled by FI schedules. However, they differed in their formulation in one important feature: While one model used a continuous function to describe the occurring probability of operant response, the other one employed an abrupt switch from one behavioral state to another. Comparing the ERM of both models with the experimental data revealed that the abrupt switch of behavioral states was an essential part in the functional mechanism of operant behavior under FI schedules.

Cognitive Psychology SUN, 1300, B

The Self as Coagulated Interaction

Guido Hucke, aron2@freenet.de

According to Duerr - successor of Heisenberg at Munich - the whole universe can be seen as one system which only consists of interaction. Sometimes this interaction coagulates into solid forms which we then call matter = substance. But at first the universe has to be understood as an ever changing process. Iwill use this metaphor for describing and defining the Self. In my (and others) opinion the Self only consists of interaction, coagulated interaction. From outside the Self seems to be something solid, and indeed our Selves are psychologically impenetrable to each other, like our bodies are physically impenetrable. From inside the Self seems to consist of all possible relationships to all possible material and mental "worlds". Using this metaphor every form of (human) communication = interaction can be understood as BEING an all comprehensive general field. Because in this point of view we ARE interaction = communication = conversation, we consist of inner and outer dialogues (see Gadamer and Luhmann). Finally, some problems with self-reflection or self-iteration will be discussed.

Cognitive Psychology SUN, 1320, A

The Chaos of Health

Mario E. Martinez, Institute of Biocognitive Psychology, Nashville, Tennessee
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This paper presents a model of health and illness based on the author's theory of Biocognition. It argues that health is a bioinformational process that constantly oscillates between chaos-like non-linearity and linearity. When this oscillation collapses into a repetitive linear loop, it loses coherence with its bioinformational field creating a rigid state of pathology. Based on the last thirty years of research in the interdisciplinary field of psychoneuroimmunology and in medical anthropology, Biocognitive theory suggests that the individual is an inseparable unit of cognition, biology and historical culture. This paper also argues that health and illness are neither exclusively biological nor totally mental. All human processes are inseparable biocognitions of mindbodyculture.The bioinformational field is contained by horizons functioning as attractors that oscillate from stability to instability in the process of communicating and learning. This oscillation is considered to be operational at all levels of the bioinformational field ranging from the cognitive to the cellular modes of communication. Biocognitive theory considers the reductionist and dualist limitations of upward and downward causality and offers an alternative the author calls contextual coemergence. This model of coemergence suggests that causality is a co-authored and simultaneous process that takes place within and between bioinformational field horizons rather than originating at either the molecular (reductionism) or cognitive (expansionism) levels of life. Contextual coemergence includes non-linear phases where Chaos theory can offer heuristic as well as practical advantages over the linear models of conventional life sciences.

Organizations SUN, 1020, B

Information & Interface

Arnold J. Wytenburg, Change Adoption Practices, arnold@originalthinking.com

Western culture is based on the notion of information as quanta, as discreet things that 'stay still.' At least since the birth of mathematics, this notion has shaped our ideas about media and their role in simultaneously constraining and making our enterprises possible. But information isn't what it used to be. Today's sociotechnical substrate is electronic information is now ubiquitous and ethereal. The landscape of this 'information space' is in continuous flux; boundaries are dynamic, uncertain and ambiguous. Information is now simultaneous, continuous, tentative 'Brownian motion' that is affective outside of the old notions of time, space and function. In this regime, the coherence of the network of ideas that act to simultaneously describe and shape our reality must dominate the cultural agenda: relationship counts more than position. Rich relationships are subjective unstable and cannot be readily negotiated outside of 'the moment.' Emphasis on insisting sameness to stay the vertigo of an overwhelming diversity of moments in flux is running its course. The nature of socioelectronic reality is highly dimensional. A culture's meaningful participation in that context requires apprehending information as fluid, the socioelectronic environment as interface, and that interface as a 'space of possibilities.'

Cognitive Psychology SUN, 1340, A

Picture Yourself: Exploring the Dynamics of Vision and Posture

Mark R. Filippi, addchiro@mindspring.com

The integrity of the relationship between vision and posture determines the conversational tone of the nervous system. It has been estimated that 90% of the brain's sensory input comes from visual sources. Even 20% of posture is associated with vision. The most powerful influences on learning potential are concrete, vivid images. Enhanced clarity, creativity and insight have been associated with a posturally modulated phenomenon called cortical facilitation. The confluence of other related systems, ranging from vagal and frontolimbic activity to the architecture of the retina itself, help us distinguish memory from experience. After a review of related clinical concepts, a series of interactive group exercises will be used to illustrate these axioms.

Organizations SUN, 1040, B

Characterizing and Exploring the Government/Industry Cluster Time-Ecology

Gus Koehler, ED>Net, koehleg@ednet.cc.ca.us

There are numerous studies of policy making, on the design, implementation and evaluation of economic development programs, on the life-cycles of government organizations and of businesses, on business networks, and on how regional economies are organized and work. But, there is little understanding of how all of these elements work together. That is, how multiple public economic development programs combine and interact on a single firm, with a large number of individual businesses, or on business networks in regional economies to produce competitive advantage. There is even less understanding of how these systems and processes grow, coevolve, and change over time. This paper will present on-going work that uses the concept of a time-ecology to investigate some of these relationships. Particular attention will be paid to how the heterochornic interactions of agent time, clock time, and nootemporal time that form public policy making and government agency activities.

Cognitive Psychology SUN, 1400, A

Simulating people's cognitive responses to health threats

Sarah Milne, University of Bath
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Ian Walker, University of Bath
Rob Lowe, University of Wales Swansea

Psychologists aim to model decision making and behaviour. Traditionally, such models assume linearity and rationality. Two studies are presented looking at the ability of non-linear models to predict decision making in response to different health threats. In Study 1, 219 men read an educational leaflet about testicular cancer and self-examination, then completed a questionnaire measuring their appraisals of the threat of cancer and their ability to cope with it. A neural network learnt to associate these variables with adaptive and maladaptive coping responses from half the participants. This accounted for 67% of the variance in the untrained participants' coping measures (multiple regression, by contrast, predicted 38%). Moreover, the dominant linear model in this field identifies only one way in which each coping response can be produced. In contrast, this data-driven analysis identified new decision-making profiles when the model's internal representations were cluster analysed. For example, two groups of people with high behavior-change intentions were found, each of which formed this intention through very different cognitive processes. This clearly shows a more complex decision-making process than has been previously recognized. Study 2 used similar techniques to explore the role of personality and individual differences in predicting intention to perform stress-reduction techniques, as well as comparing this approach with that of an adaptive neural fuzzy logical model. These studies demonstrate that non-linear techniques are of particular value where a behavioral/personality variable must be predicted from a complex array of other measures. Theoretical and practical implications will be discussed.

Organizations SUN, 1100, B

Effects of Verbalization and Personnel Replacement on Group Coordination, and Leadership Emergence in Coordination-Intensive Tasks

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Benjamin R. Bock, Philip Caldwell,
Robert W. Bond, Jr., Marquette University

Coordination occurs when two or more people do the same or complimentary tasks simultaneously; its explanation game theory, nonlinear dynamics, and implicit learning theory. The objective of the study was the to assess the impact of the replacement of group members, verbal versus nonverbal communication, and leadership emergence on the dynamics of coordination acquisition and transfer. The general dynamic was one of self-organization if learning was complete enough, and chaos where self-organization was not complete (Guastello & Guastello, 1998). Leadership was hypothesized to emerge according to the swallowtail catastrophe function that was identified in previous studies (Guastello, 1998; Zaror & Guastello, 2000). In the first of two experiments,12 4-person groups were allowed to discuss the coordination (card game) task while performing it; 12 other groups worked nonverbally. Varying numbers of group members were replaced during the game. Split-plot ANOVA showed that verbalizing groups performed better than nonverbalizing groups overall and showed more acute coordination learning curves, but verbalization did not compensate for the replacement of personnel. Groups that changed 1 or 2 players showed positive coordination transfer, but groups that changed 3 players did not. Nonlinear regression for temporal dynamics within verbalizing groups showed asymptotic stability for initial coordination learning and transfer to a difficult rule, a chaotic function when replacements were introduced, and asymptotic stability again when the team with replacements switched to the difficult rule. The dynamics for nonverbalizing groups were similar. In the second experiment, 26 groups played a variation of the game either verbally or nonverbally; there were no personnel replacements. The effect of verbalization on coordination learning was replicated, but the marginal value of verbalization dissipated over time. A questionnaire measured leadership emergence at the end of the game along with other social contributions. The strength of leadership emergence did not differ between verbal and nonverbal conditions, although differences in other social contributions were observed. The probability distribution of leadership ratings was consistent with current developments in nonlinear dynamical systems theory. Most nonlinear functions depicted the self-organization dynamics, but both a chaotic and self-organizing function were observed in difficult coordination situations.

Organizations SUN, 1320, B

Situativity of Learning within Groups: Coevolutionary Dynamics Over Time Using Kauffman's NK Model

Yu Yuan, University of Southern California
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Bill McKelvey, UCLA

Rapid organizational learning capabilities are critical in high velocity environments. Situativity learning theory holds that contextually relevant communication interactivity is key to improved organizational learning. We embellish situativity theory with ideas from the study of complex adaptive systems, in particular Kauffman's NK agent-based model, somewhat altered (N = size; K = # of links among agents). We test nine propositions that reflect nonlinear dynamic, multi-level, coevolutionary processes, over time, that affect communication interactivity and the rate and amount of organizational learning. Some are: · Amount of group learning is a nonlinear nonmonotonic (inverted U) function of K. · Rate of group learning is a nonmonotonic function of increasing K and N. · Amount and rate of group learning is also a nonlinear nonmonotonic (inverted U) function of the standardized measure of K, that is, K/(N-1). The greater the differentiation of communication ties toward stars and isolates, the lower the level of group learning. Our program docks with tables reported in Kauffman (1993) with a correlation of 0.976. Some results are: As communication interactivity becomes denser, and rate of learning speeds up, there are diminishing returns to improving group learning supporting Kauffman's complexity catastrophe theory. After standardizing K by N-1, we find that the catastrophe effect remains, but learning becomes a linear function of separate variables increasing interactivity speeds up the rate of group learning, but it diminishes the amount of learning. Altering the distribution of communication stars and isolates has a

Organizations SUN, 1340, B

Rugged Landscapes and Complex Supply Networks

Kevin Dooley, Arizona State University
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Tom Choi, Arizona State University

In many industries a majority of a product's value is added not by "final assemblers" (such as General Electric or General Motors) but rather by suppliers, arranged in a complex web of interconnectivity. These supply networks are huge in size—for example, Daimer-Chrysler has 8000 "key" suppliers—and have material and information flows that are not necessarily simple and sequential. We shall apply Kauffman's rugged landscape model to better understand the dynamics of these supply networks, with respect to their formation (supplier selection), and the design and manufacture of products. In particular, it appears there is a basic trade-off between simplicity of a product or process design, as achieved by modularity, and the value embedded in

integral designs, which tend to add complexity to the management of the supply network.

Philosophy SUN, 1500, A

Nonlinear World of Dr. Suess

Terry Marks-Tarlow, Creativity Research Institute of Southern California
markstarlow@hotmail.com

This theoretical paper analyzes the children's stories and visual images of Dr. Suess, whose fantastic universes have supplied the early mental diet for generations of dynamical researchers. Fractals are evident in birds roosting upon birds among other unusual beasts. Horton Hears a Who reveals a critical bifurcation point, while the Cat in the Hat illustrates paradoxical dynamics typical of psychological defenses.

Organizations SUN, 1400, B

Mapping Social Ecosystems

Ken Baskin, Life Design Partners
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This session will demonstrate a methodology for mapping human complex adaptive systems, using the U.S. healthcare system as an example. By focusing on relationships within any such system, this methodology can help the mapper understand that any discrete piece of the system (a regional system of professional healthcare providers, for example) is embedded in a larger social context or "social ecosystem" (the network of communities across that region). By recognizing the relationships throughout such a social ecosystem, mappers also realize many leverage points (the potential of the family in the health care process) that already exist and can be used to improve the performance of these systems.

Philosophy SUN, 1520, A

A Conversation on Emergence

Jeff Goldstein, Adelphi University
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Topics: (a) theoretical strategies, (b) discontinuity versus dissimilarity, (c) appropriate constructs and measures, (d) self-transcending constructions as a new formalism for emergence, (e) levels without hierarchy, (f) wholes without holism.

Organizations SUN, 1500, B

Sensemaking in teams: Does diversity affect the ability of complex-adaptive systems to make sense

Brigitte Fleeman, University of Texas at Austin, b.fleeman@mail.utexas.edu

Using Weick's (1995; 2001) framework of sensemaking and the insights gained from research on complex-adaptive systems, I am interested in empirically investigating the question of whether and how differences among agents affect the ability of organizations, as complex-adaptive systems, to make sense. In general, diversity is a requisite and hallmark of complex adaptive systems. In the organization literature, diversity is seen as both an asset as well as a liability. On the one hand, diversity often leads to surprising and unique inputs giving rise to novel and comprehensive considerations. On the other hand, diversity can hinder organizational performance when multiple interpretations must be understood and different cues integrated from a confusing array of possibilities. This may add to the uncertainty and difficulty in making sense together. In applying these perspectives to the interactions and relationships in diverse groups, an interesting tension emerges: What levels of diversity and differences are helpful in making sense together? What does the difference among agents do to the ability of organizations as complex-adaptive systems to make sense? Using a naturalistic inquiry approach based on a constructivist paradigm (ethnographic methodology), insights about dynamic patterns (Kelso, 1997) and complex adaptive systems yielded from computer simulations (Axelrod, 1997; Holland, 1995; Kauffman, 1995) and philosophical considerations (Cilliers, 1998; Hardy, 1998; McDaniel & Walls, 1997; Prigogine & Stengers, 1984; Waldrop, 1992), I will be observing the process of sensemaking in less or more diverse teams (possible setting: hospital).

Organizations SUN, 1520, B

The Dynamics of Local Rules in Hospital Admission Processes

Beverly C. Walker, bewalker@alphalink.com.au
Tim Haslett, Monash University

This paper reports on research into admission practices at a hospital that provided sub acute extended care. A System Dynamics model of the patient flow through the hospital was built to show the impact of the local rules used by the medical registrar. Local rules are behaviours that are local, and often idiosyncratic, adaptations to the local environment. Such adaptations can have a significant impact on organisational performance. In the hospital, patients were admitted from two large acute hospitals and from the community sources, into two different streams of care a within the hospital. The process by which they were selected for admission set up the dynamics of patient flows within the hospital. These dynamics involved the acuity of the patients and the demands they placed on the medical systems within the hospital. Hospital funding in Victoria is based on length of stay and occupancy rate. The types and acuity of patients being admitted had a profound influence of these funding bases. The local rules used by the medical registrar, in turn, had a profound influence on the types of patient being admitted. The System Dynamics model demonstrated the impact of these local rules. During the process of building the model, it became clear that neither the medical registrar, nor

senior administrators within the centre understood the impact of the local rules.

Philosophy SUN, 1600, A

Is Chaos Research Normal Science?: Logical Foundations of Postmodern Inquiry

M. Jayne Fleener, University of Oklahoma
fleener@ou.edu

The first part of this presentation will delineate the modernist mind-set and the inherent logic of domination underlying modern science. Scientific, social, and philosophical revolutions leading to process philosophies, pragmatism, chaos theory, hermeneutics, and systems theory will be explored as important seeds to the developing of Erwartungshorizonten, or the horizons of expectation for a science of emergence and postmodern inquiry. The second part of the presentation will develop the logics of relationship, meaning, and systems as postmodern inquiry. The logic of relationship has its modern manifestation in the works of Whitehead and Dewey. Inquiry from a relational perspective will be explored as the continuation of Poincare's efforts and as the genesis of recursive and emergent systems theories. The logic of meaning, as found in Nietzsche and developed in Wittgenstein's language games approach, has implications for ideas about truth and the goals of inquiry. If meaning and truth cannot be provided objective and certain foundations, reflecting a correlation between our theories and some underlying reality, then how are we to interpret and understand our goals of inquiry? Finally, a logic of systems, coemerging with chaos dynamics, dissipative structures, and post-Neo-Darwinism, together with the logics or relationship and meaning, will be offered as perspectives from which a postmodern science and approach to inquiry may proceed. The final portion of the presentation will provide an example of the Mandelbrot set as an analytic tool to explore the language games of a third grade mathematics classroom.

Organizations SUN, 1540, B

Using Complex Adaptive Systems Models for Organizational Consulting

John Loveland Link
johnwlink@hotmail.com
Jo Lee Loveland Link

The co-authors, John and Jo Lee Loveland Link, have been working in the field of chaos and complex adaptive systems as applied to organizations since 1991. At that time, the simulation now called Chaos, Inc. was born an experiential non-computer-based full-day session engaged participants in chaotic and dynamical events. Without a prescribed agenda or outcomes, the simulation models real business life. In addition, the authors have integrated principles, practices, methodologies, and approaches that draw on an understanding of complex adaptive systems (CAS) and apply them to consulting interventions. This presentation will provide highlights of the authors' learning in regard to applications of CAS concepts in organizational systems. The focus will telescope on three organizational uses of CAS: diagnostic, descriptive, and experiential. The authors will then describe the chief emergent dynamics they see, based on their experiences and experimental approaches. In addition, the authors intend to use CAS methodologies including discovery analysis and difference questioning, to elicit participants' insights and experiences regarding applications of CAS in organizational life and potential opportunities to "morph" further evolutions.

MONDAY, AUGUST 5

Business Meeting
0900-1000

Parallel Workshops: *1030-1530*

Workshop: An Introduction to Complexity Science for Organizational Researchers

Kevin Dooley, Arizona State University

The workshop will introduce some basic concepts of complexity science. First, we shall discuss the architecture of complex adaptive systems, using Holland's model: agents, fitness functions, behavioral rules, boundaries, tags, connectivity and flow, and nonlinearity. Next, some basic properties of complex systems will be discussed: self-organization and emergence, self-organized criticality and power laws, rugged landscapes, organizational dynamics, and social network theory. In the afternoon we shall discuss various applications of these models, including examples in medical error, supply chain management, organization change, and knowledge management. Emphasis will be on discussion, experiential learning, and thoughts on how to move from concept to application.

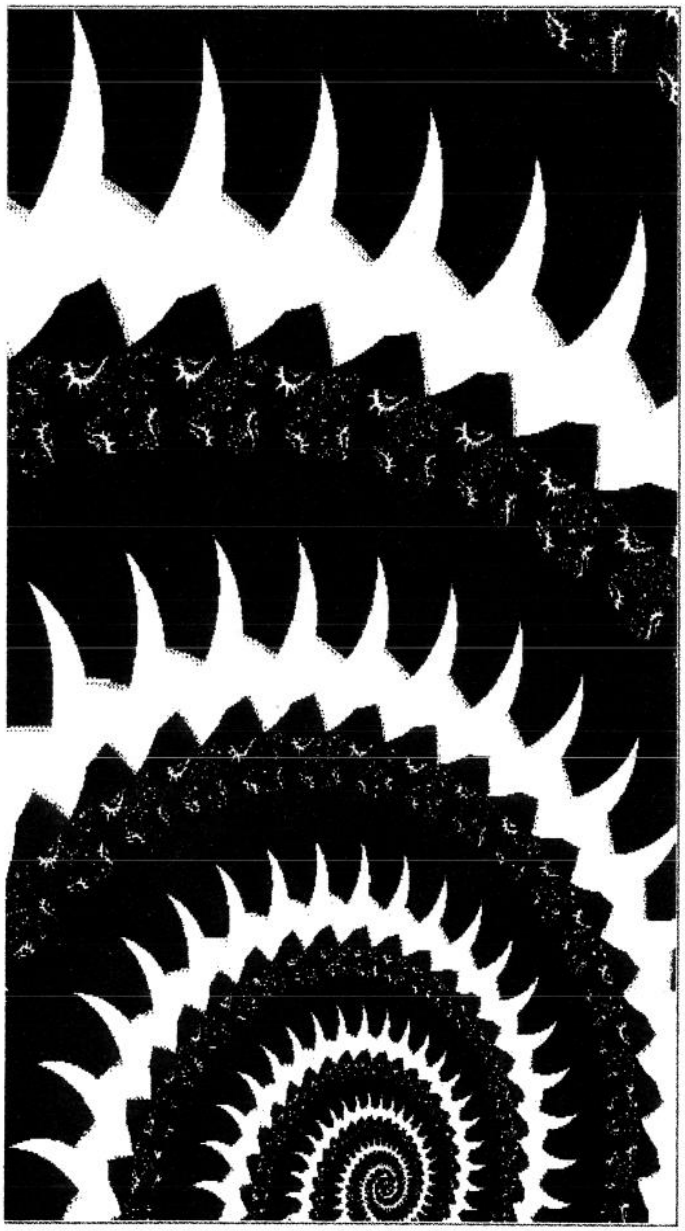
Workshop: Nonlinear Perspectives on Rhythm, Chaos, and Control in Human Biology: A Discussion of Theories and Methods

Robert Porter, Ph.D., Workshop Coordinator, Directions for Mental Health (Clearwater FLA) & Lambda Consulting (Tampa FLA); Franco Orsucci, M.D., Ph.D., Institute for Complexity Studies, Rome, Italy; Dick Bird, Ph.D., U. of Northumbria, UK; Susan Mirow, M.D., Ph.D., U. of Utah

Many nonlinear systems display periodic, stochastic, chaotic, and continuously-adaptive behaviors. Nonlinear biological systems, including the cardiopulmonary system, central nervous system, and the muscular-skeletal system, display these behaviors. There is a vast, classical, literature describing these biological systems and their properties. How does a nonlinear

systems approach gives us a clearer perspective on how these nonlinear systems work, how they malfunction, or how they may be manipulated or repaired? In addition, what measurements and what sorts of analyses do a nonlinear approach demand? The workshop will address these questions using examples of data collection and analysis from a variety of research areas. A focus of the workshop will be the contrast between the more traditional interpretations and the nonlinear ones. This participatory workshop is designed for those scientists at an intermediate-to-advanced level who (1) are interested in finding out more about what is going on in other areas and who (2) are interested in discussing how the theoretical perspective informs research. A basic understanding of human biology, nonlinear science, and research methods will be assumed. Enrollment limited to facilitate productive discussion.

FINIS



Manuscripts Accepted by *NDPLS*

The following regular articles have been accepted for publication by *NDPLS* and received in their final form. This listing continues from the last list that appeared in the May 2001, *Newsletter*.

Ahmed, E., & Hegazi, A. S. On the stability and persistence of some ogliopoly models.

Dooley, K. J., Corman, S. R., McPhee, R. D., & Kuhn, T. Modeling high-resolution broadbant discourse in complex adaptive systems.

Haslett, T., & Osborne, C. Local rules on organizational landscapes.

Kaizoji, T. Speculative price dynamics in a heterogenous agent model.

Koeher, G. Time, complex systems and public policy: A theoretical foundation for adaptive policy making.

Mazzucato, M., & Semmler, W. The determinants of stock price volatility: An industry study.

Sabelli, H., & Abouzied, A. Definition and empirical characterization of creative processes.

Thomasson, N., Pezard, L. Boyer, P., Renault, B., & Martinerie, J. Nonlinear EEG changes in a 48-hour cycle manic-depressive patient.

Van Orden, G. C., Moreno, M. A., & Holden, J. G. A proper metaphysics for cognitive performance.

Yizhaq, H. & Meron, E. Urban segregation as a nonlinear phenomenon.

News

NDPLS is pleased to report that its economics articles will be abstracted in *JEL/EconLit*. *JEL* (*Journal of Economic Literature*) is the abstracting system operated by the American Economics Association. *NDPLS* was approved for indexing in *MEDLINE* (National Library of Medicine, electronic version of *Index Medicus*) last fall, and *PsycLit* (American Psychological Association) in 1998. The *NDPLS* and Kluwer staff continue to search for additional highly regarded abstracting services.

Two special issues are in the works. The April, 2002, issue will be on the topic of Nonlinear Dynamics and Evolutionary Economics, which has been guest-edited by Akio Matsumoto and Yuji Aruka. *NDPLS* has also received a bumper crop of manuscripts that survived the review process for the Creative Theory Papers, which was announced last year. In response, the Creative Theory Papers will be published in two consecutive issues, October, 2002, and January, 2003.

Arthur M. Sackler
COLLOQUIA
OF THE NATIONAL ACADEMY OF SCIENCES

ADAPTIVE AGENTS, INTELLIGENCE AND, EMERGENT HUMAN ORGANIZATION:
CAPTURING COMPLEXITY THROUGH AGENT-BASED MODELING

OCTOBER 4-6, 2001

The Arnold and Mabel Beckman Center, Irvine, CA

Organized by Brian J.L. Berry, L. Douglas Kiel, and Euel Elliott

I. Implications of Agent-Based Modeling for Understanding Human Rationality & Learning
Rosaria Conte, Italian National Research Council - Chair
Blake LeBaron, Brandeis University
Susanne Lohmann, UCLA
William McKelvey, UCLA

II. Cooperation & Competition as Factors in Emergent Human Organizations
Joshua Epstein, The Brookings Institution - Chair
Dwight W. Read, University of California at Los Angeles
Peter Danielson, University of British Columbia
Yoshimichi Sato, Cornell University & Tohoku Univ.

III. Economic Agents & Markets as Emergent Phenomena
Leigh Tesfatsion, Iowa State University - Chair
Cars Hommes, University of Amsterdam
Jeffrey Kephart, Watson IBM Research Center
Michael Macy, Cornell University
Charles Plott, California Institute of Technology

IV. Agent-Based Modeling as Public Policy Flight Simulators
John Holland, University of Michigan - Chair
Kathleen Carley, Carnegie Mellon University
George Gumerman, University of Arizona
Scott Moss, Manchester Metropolitan University

V. Platforms & Methodologies for Enhancing the Social Sciences through Agent Based Simulation
Nigel Gilbert, University of Surrey - Chair
Robert Axtell, The Brookings Institution
Eric Bonabeau, Icosystem Corporation
Lars-Erik Cederman, Harvard University
Miles Parker, Biosgroup, Inc.

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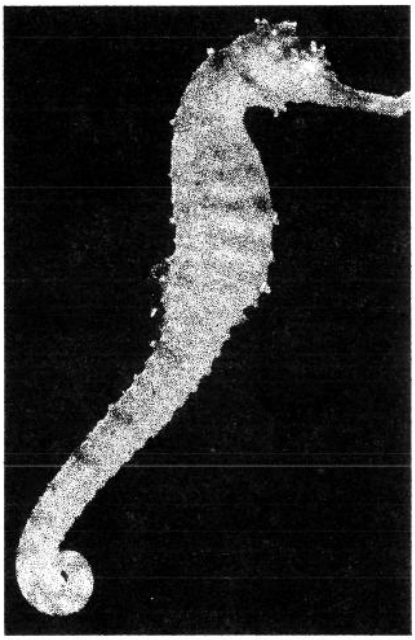
Nonlinear Dynamical Bookshelf



Arrow, H., McGrath, J. E., Berdahl, J. L. (2001). Small groups as complex systems. Thousand Oaks, CA: Sage. 336p + viii. ISBN 0-8038-7229-6 hardcover and –7230-X paperback. What are groups? How do they behave? and why? Arrow, McGrath, and Berdahl tackle these questions in their general theory of small groups as complex systems. Drawing on concepts distilled from general systems theory, dynamical systems theory, and complexity and chaos theory, they view groups as adaptive, dynamic systems that are driven by interactions among group members and by transactions between the group and its embedding contexts. They explore how the global processes of group formation, development, and adaptation emerge from changing patterns of connections among a group's members, tasks, and technology. This network of relations among people, tools, and tasks is in turn shaped both by external pressures on the group and by a combination of individual and collective purposes and goals that evolve as the group interacts over time. -- *Publisher*

Ben-Avraham, D., & Havlin, S. (2000). Diffusion and reactions in fractals and disordered systems. Cambridge, MA: Cambridge University Press. This book expands on our review paper in Advances in Physics, 1987, and is written in a pedagogical style, suitable for senior undergradiates and graduate physics students, and for researchers requiring an introduction to the field. Each chapter ends with a series of suggested exercises, a list of open problems, and suggestions for further reading. We hope that you and your group will find the book useful, both as a reference text and as a teaching aid. –*Authors*.

Ding, M. et al, (Eds.). (2001). The proceedings of The 5th Experimental Chaos Conference. Singapore: World Scientific, circa 460 pp. ISBN 981-02-4561-0 US$114.00. The coverage is very interdisciplinary, from physical to biological science, and some very general methodological topics. It looks like the sort of book one recommends for the institutional library, and then photocopies the bits that pertain to one's own problems. The methodologies have advanced since the now almost old-fashioned calculations of Lyapunovs, Hursts, Renyi dimensions, surrogates, and so on. – *Robert A. M. Gregson*.

Fradkov, A. L., Miroshnik, I. V., Nikiforov, V. O. (1999). Nonlinear and adaptive control of complex systems. Boston & Dordrecht: Kluwer. 528 p. USD$255. ISBN 0-7923-5892-9. This volume presents a theoretical framework and control methodology for a class of complex dynamical systems characterised by high state space dimension, multiple inputs and outputs, significant nonlinearity, parametric uncertainty, and unmodeled dynamics. A unique feature of the authors' approach is the combination of

rigorous concepts and methods of nonlinear control (invariant and attracting submanifolds, Lyapunov functions, exact linearization, passification) with approximate decomposition results based on singular perturbations and decentralization. Some results published previously in the Russian literature and not well known in the West are brought to light. Basic concepts of modern nonlinear control and motivating examples are given. *Audience:* This book will be useful for researchers, engineers, university lecturers and postgraduate students specializing in the fields of applied mathematics and engineering, such as automatic control, robotics, and control of vibrations. – *Publisher*.

Haber, R., & Keviczky, L. (1999). Nonlinear system identification: Input-output modeling approach. Vol. 1: Nonlinear system parameter identification. Vol. 2: Nonlinear system structure identification. Boston & Dordrecht: Kluwer. 840p. USD$335.00. This two-volume handbook presents a comprehensive overview of nonlinear dynamic system identification. The books include many aspects of nonlinear processes: modelling, parameter estimation, structure search, nonlinearity and model validity tests. The book includes not only nonparametric models but also parametric models which include a limited number of parameters. Time domain parameter estimation is

dealt with in detail; frequency domain and powerspectrum procedures are also included. *Audience:* This work is intended for postgraduate students, researchers and engineers whose work involves nonlinear systems. Many examples, case studies and experimental identifications of real processes have been included.

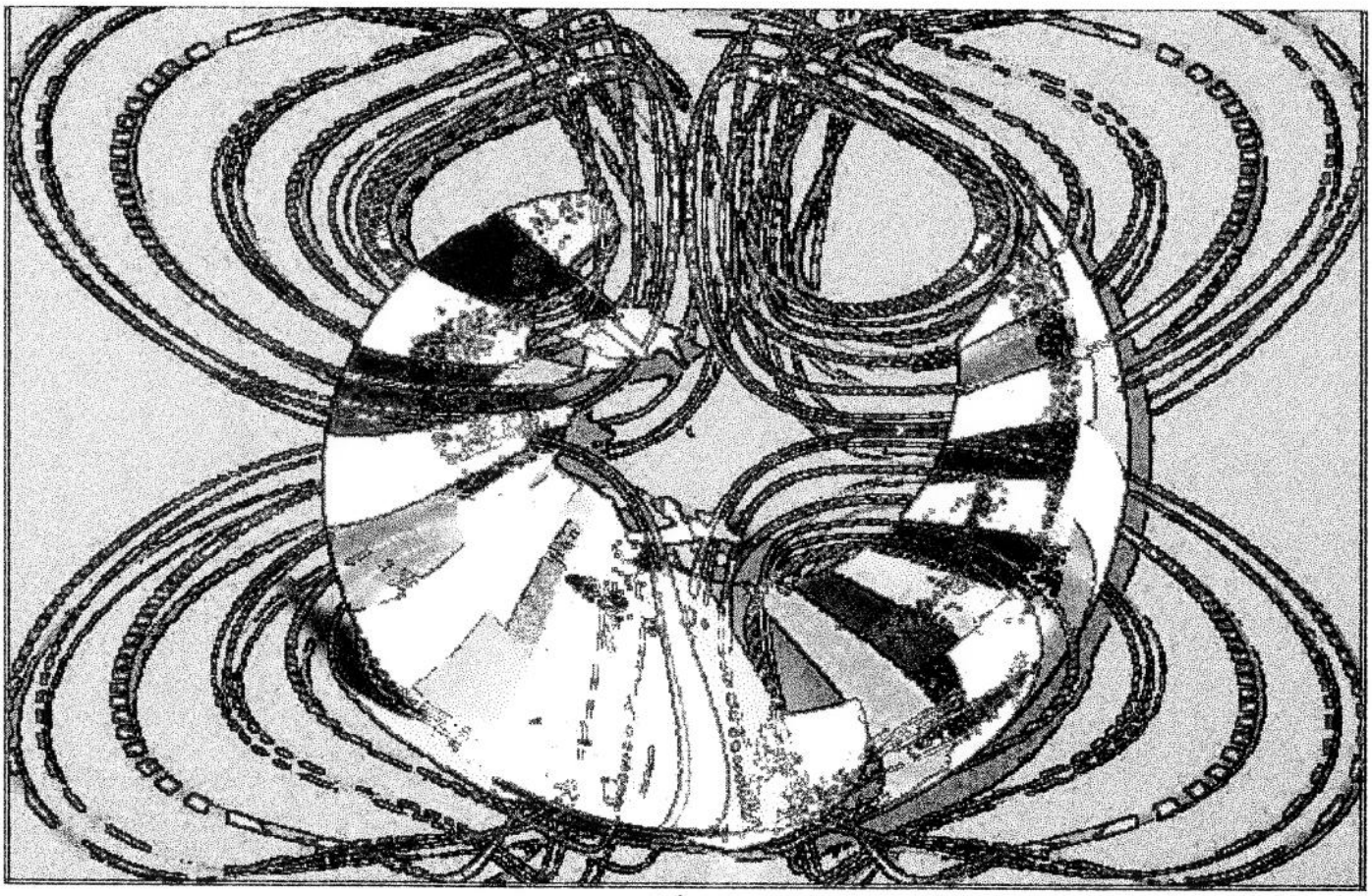
Haykin, S. et al. (2001). Nonlinear dynamical systems. New York: Wiley. 312pp hardbound ISBN 0-471-34911-9 US$ 80.00. I want to draw everyone's attention to a book review by Karl Pribram in *APA Review of Books ,2001, 46*, issue 2, April, pages 123 et seq. The review is entitled Free Will but is a trenchant assertion about the relevance of nonlinear dynamics to understanding brain processes and volition. It is the sort of review you can show to intelligent students. *–RAMG*

Lesmoir-Gordon, N., Rood, W., & Edney, R. (2000). Introducing fractal geometry. Totem Books. ISBN 1-84046-123-3. It uses a lot of really cool drawing to explain things. Sketches of Ian Stewart and others are included. Recommended for the beginner. *–Gus Koehler.*

Perry, J. N., Smith, R. H., Wolwood, I. P., & Morse, D. R. (2000). Chaos in Real Data: Analysis of Non-Linear Dynamics from Short Ecological Time Series. Boston & Dordrecht: Kluwer. 236p. US$122. ISBN 0-412-79690-2. *Chaos in Real Data* studies the range of data analytic techniques available to study nonlinear population dynamics for ecological time series. Several case studies are studied using typically short and noisy population data from field and laboratory. A range of modern approaches, such as response surface methodology and mechanistic mathematical modelling, are applied to several case studies. Experts honestly appraise how well these methods have performed on their data. The accessible style of the book ensures its readability for non-quantitative biologists. The data remain available, as benchmarks for future study, on the worldwide web. *Publisher*

FRACTALS THIS ISSUE BY

J. C. SPROTT!



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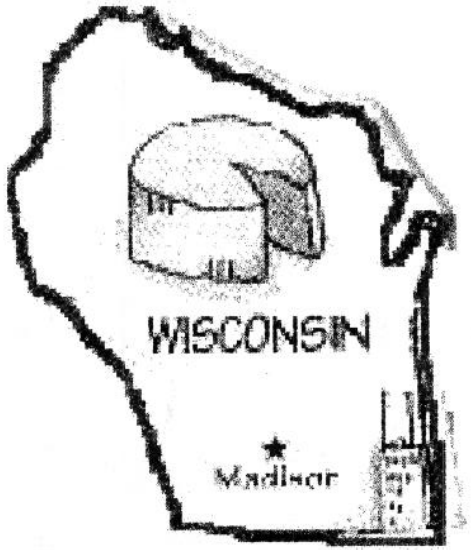

Program Issue for the 11th Annual International Conference in MADISON, WI