Society for Chaos Theory in Psychology & Life Sciences

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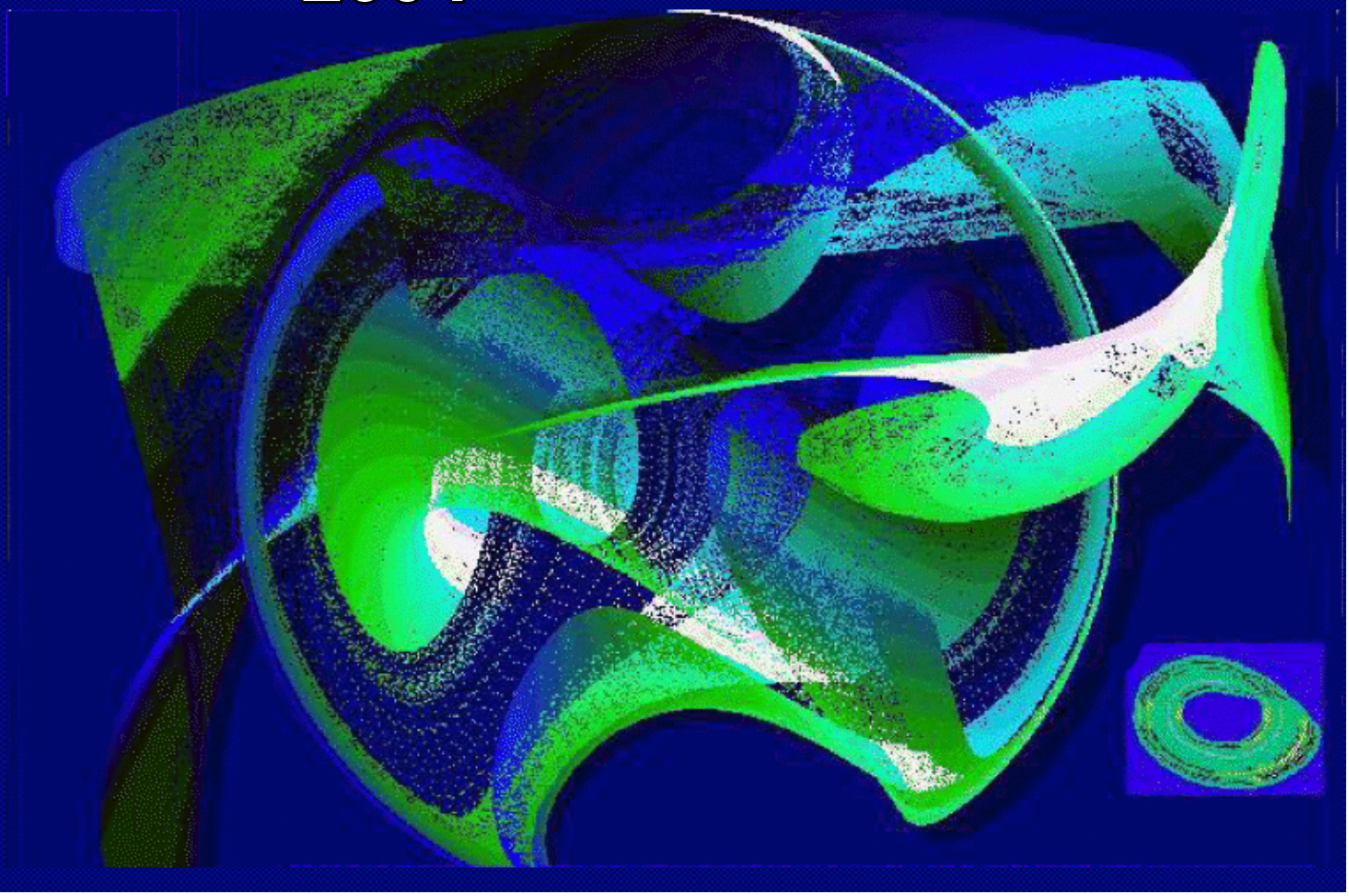
Abstracts to the 14th Annual International Conference, Milwaukee, WI

2004



2004 CONFERENCE

SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY & LIFE SCIENCES

July 15-18, Marquette University, Milwaukee, WI

PROGRAM ABSTRACTS*

Listed Alphabetically by First Author

Where are We?
Susan Aaron, University of Toronto, OISE

Where are we? A model of an installation was created to ponder how we interact with a world; where we "know" or solidify a relation of body to world. If we are to determine the balance between bodily functions and the abstracts that link and sustain them beyond the natural rudiments of our environments, how do we form these abstracts, and where are they becoming redundant? Using a model of an art installation, the participant plays with the abilities of the reactive room to respond. The responses are sound, and graphic via tactile actions tracked by infrared sensors, kinetic through reactive cameras, and breath and voice, through microphones. These simple actions don't relay information, nor relate to a form and then compute the reactions. The room interacts at the point where one might solidify one's realities, to the formation of shared knowledge, but more interestingly it begs the question as to where do we require change as we play with these dynamics in abeyance of the body. The technology responds as unique to each individual in a manner refined of cultural semantics except for perceptions which in themselves become part of the play. What is whole and part comes into question as does the need for plotting, when paradigms of reaction with our technologies facilitate change more readily. It offers reflection on homeodynamics and alternate uses of technology in a world where we are now lost without it, but continually do not want to be driven by it.

Exploring the Limitations of Utilitarian Epistemology to Economic Science
Yuji Aruka, Economist, Chuo University, Japan

The principles of political economy born before utilitarianism seized power in economics were entirely irrelevant to the kind of utility maximization. Utilitarianism made economists share a unique definite purpose for the art of life, thus becoming to play the crucial role in arguing economics almost everywhere. We can easily find our main prototype of modern economic ideas from the classical source of literatures of utilitarianism, in particular, James Mill who suggested the ``Art of Life," whose ultimate end is happiness in the society. Put another way, utilitarianism is a kind of art which has ultimately recourse to the sole value judgment on happiness either personally or interpersonally. In the first section of this article, the author summarizes extbf of utilitarian economics as the art of life. In the second section we explore the failures of homogeneous agent of economic rationality, in particular, as for interpersonal comparison. We then suggest a new art of life to understand the reality by constructing a macroscopic microeconomics. We investigated the basic properties of utilitarian economics whose domain is excessively limited to the class of volition and omitting the other important aspects of human behavior. As based on this construe of utilitarian economics, we shall make the utility function ``evolute" by extending the field of domain, indeed. We really need the evolution of utility function. In the final subsections, we have looked around some ways to introduce a macroscopic order in microeconomics. It is quite instructive that microeconomic properties have been revealed in association with some macroscopic variables. Without any filed of macroscopic order, we cannot refer to some genuine microscopic properties. Economics has ever been irrelevant to such a concept of temperature.

Educating to Accommodate a World of Complexity
Steve Axley, Management Dept., Western Illinois University,
Tim McMahon, Teaching Effectiveness Program, University of Oregon

As a paradigm for understanding and effective adaptation within the world, Newtonian mechanism is ill-fitted with much of today's reality of accelerating change, volatility, and rampant uncertainty. Observers of education as an institution note that mechanism has long found popular expression in pedagogical thought and design. Critics argue that many resulting instructional processes and methods eventually inculcate students, by intention and default, with mechanistic assumptions and values such as stability, predictability, control, certainty, and rationality (among others)--with attendant and far-reaching practical implications as a consequence (cf. Aram & Noble, 1999; McAndrew, 1997; Rifkin, 1980). The present paper offers complexity science as a good "fit" with contemporary realities that students will face, arguing that educational methods and processes drawing upon it can better prepare students for a world of change and uncertainty, where adaptiveness and the ability to work with ambiguity, paradox, and surprise are essential. Through the conceptual lens of "requisite variety" (Ashby, 1956), we contend that instructional methods and processes predicated on complexity science are needed to create students whose "variety" matches that of a high-variety world. More specifically, we profile our own teaching methods and processes explicitly based on complexity science notions such as sensitive dependence on initial conditions, self-organization, distributed control, emergence, recombination, coevolution of system agents, nonlinearity, attractors, and the edge of chaos, among others. We believe these educational methods and processes mirror the complexity of the world and best serve the learning needs of students who must live and work within that world.

The Effect of Cue Predictability on Long-Range Dependencies
Brandon C. Beltz, George Mason University
Christopher T. Kello, George Mason University

Four experiments were conducted in order to test the effects of cue predictability on long-range dependencies of measures of human response behavior. Predictability was manipulated in terms of the timing or identity of cues to respond. Long sequences of cues were given to participants, and time series of button-press latencies and button-press durations were analyzed. In Experiment 1, participants pressed a button every time they saw an X on the screen, and predictability in the timing of Xs was manipulated. In Experiments 2 and 3, participants pressed one of two buttons depending on the directions of arrow stimuli, and predictability of the arrow directions was manipulated. Results of the first three experiments showed consistently that long-range dependencies in the time series of button-press latencies were stronger when the cues were predictable. By contrast, long-range dependencies in the time series of button-press durations were equally strong regardless of cue predictability. The fourth experiment confirmed that effects in the first three experiments were due to predictability of the stimulus cues, rather than predictability of the participant s behavior. The experiments are discussed in terms of theories about the source of long-range dependencies in human behavior. It is argued that long-range dependence is the signature of self-organization intrinsic in the dynamics of the human system. In light of this theory, the dissociation between button-press latencies and button-press durations was evidence that the signature is weakened only when the intrinsic dynamics are perturbed, i.e., only in behaviors that must respond to extrinsic, unpredictable events.

Information Systems are Dynamical Systems
Don Booker, Pace University

This paper will establish a framework for a perspective that 'Information Systems Are Dynamical Systems' from within the academic discipline of information systems. The currently popular academic models answering the question "What Is Information Systems?" attempt to situate information and computational concerns within an organizational or social context and address a varied selection of practice based perspectives and concerns such as data base design and utilization (e.g. data warehousing), global and local network administration, organizational behavior and psychology methodologies addressing such as those examining 'user friendly'(and user 'hostile') models, some research and policy modeling approaches addressing 'social or public policy' issues, and from management science models and methods. An alternative perspective grows out of the MIT system dynamics modeling tradition and the study of dynamical, chaotic and complex systems. It builds upon the feedback structure of both information and systems in order to emphasize and explore the inherently complex dynamical and nonlinear nature of information system behavior. Forrester defined a system in terms of feedback. This paper explores a multidimensional view of information in order to reconcile the more formal definitions of information provided by Shannon, Weaver, and Chaitin, with each other, and with formal language models, automata and complexity theory and finite graph network based models. It provides a multidimensional definitional framework. The paper presents a model of information as context sensitive dialogue in response to postmodernist criticisms of the construction, and deconstruction, of meanings.

Symposium

Crisis Theory in Behavioral Health: Danger May be an Opportunity, Bifurcated Adaptation

Michael Butz, Washington County Psychotherapy Associates, P.A.
Karen Kesselring, Washington County Psychotherapy Associates, P.A.,
Corey Schwinn, Washington County Psychotherapy Associates, P.A.,
David Whalen, Washington County Psychotherapy Associates, P.A.,

Crisis theory, that is theory dedicated to the treatment of crisis work in behavioral healthcare, has often used the notion translated from Asian culture that in danger there is opportunity (represented by two symbols brought together to form a term roughly translated as crisis in Euro American language forms). Often, however, crisis theory as a body of literature does not adequately discriminate between the notions of equilibrium, homeostasis and nonlinear change processes. By nonlinear change processes, we mean in quasi-scientific language, notions like chaos and complexity theories. What, then, does a crisis connote in the Euro American culture from the point of view of behavioral science; and moreover what do notions like chaos and complexity bring to the table? In this paper it is suggested that the notions of coherence, intrapsychically and interpersonally, and dynamic living systems are key considerations in describing the differences between chaos, complexity, equilibrium, and homeostasis. That, each connote a different notion about how dynamic living systems develop through crises, and this provides greater depth to crisis theory which may serve to inform interventions performed by clinicians in the field.

Building a Multiple-pattern, Predictive Model of Interactive Effects, for Causal Analysis of Social Data

Martha Ross DeWitt, Research consultant, Milwaukee, WI

Designing a research methodology to develop and test overarching theory formulations is a scientific challenge in any field, but is especially difficult in the social sciences, where observations not only involve human subjects and social environments that are ever changing and highly variable, but also observers who are products of social environments that might be very different from the ones being observed. Given that a fundamental goal of scientific investigation is to be objective, it is important that social researchers be aware of a full range of possibilities when they study causal sequences that appear to precede outcomes of interest in their research. Toward this end, a methodology is suggested that can be used with well known techniques of statistical analysis to sort out the complexities of human social responses and predict aggregate behavior, while testing theoretical formulations that are free of normative assumptions about what "should" be happening in any given environment. This approach is not possible if the research is limited to linear path models. However, multiple paths have proven to be difficult to conceptualize and operationalize. Methodologists have relied on intervening variables and data transformations to adapt their models to their data, and systems theorists have tended to rely on feedback effects. But these adjustments do not fully anticipate or adequately account for multiple paths or multiple effects. As a remedy, theory-based models of interactive and multiple effects are proposed, to identify 'patterns' of response that predict and explain personal and societal transformations, including radical social change.

The ASU Software Factory: Complexity Theory in Practice and Research

Kevin Dooley, Arizona State University

The ASU Software Factory (SF) is a professionally-managed center within Arizona State University providing software development support to ASU researchers. The SF also provides a setting for social science and software engineering research. This talk will discuss how the SF embodies both the application of and research into complex social systems. Operationally, the SF uses an agile development process characterized by simple rules and interaction, as opposed to the traditional, mechanical approach to developing software. In its research, the SF collects a variety of data, including ubiquitous audio data, enabling a real time social network to be observed. We will discuss the challenges of both implementing and study complexity in this social system.

The Semantic Evolution of the Journal NDPLS

Kevin Dooley, Arizona State University

Nonlinear Dynamics, Psychology, and Life Sciences is the flagship journal of SCTPLS. In this paper we shall present the results of a semantic analysis of the contents of NDPLS over its eight year history using Centering Resonance Analysis (CRA). CRA is a novel form of text network analysis which identifies influential words and their inter-relationships. CRA is based on centering theory which states that people position words within a stream of discourse in order to create coherence of meaning. We shall apply CRA to papers published in NDPLS, and identify themes and trends. We will also link these findings to the dynamics of the chaos and complexity discipline more generally.

The Brain as Hermeneutic Device: Code Generation, Mood Regulation and Navigation
Péter Érdi, Kalamazoo College and KFKI Res. Inst. for Part.& Nucl. Phys., Hung. Aacd. Sci, Budapest.

In the first half of the lecture an attempt will be given to reconcile the "device approach" and the "philosophical approach" to the brain. Systems exhibiting high structural and dynamic complexity may be candidates of being hermeneutic devices. The human brain, which is a structurally and dynamically complex device, not only perceives but also creates new reality: it is a hermeneutic device. In the second half of the lecture the connection between different structures being at different hierarchical level of the cortico-hippocampal formation and their functional role is discussed. At least three different functions, code generation, mood regulation and navigation is being integrated into a coherent conceptual framework.

A Child of Chaos: Applications of Intelligent Design - Part 1
Mark R. Filippi, Private Practice in Larchmont, NY
George Muhs, University of Bridgeport College of Chiropractic

In recent years, the paradoxical connection between science and theology has been finding a forum in the work surrounding the maturation of the Intelligent Design movement since 1998. Intelligent Design (ID) studies the flow of information through pathways induced by intelligent causes in a given system. Biochemist Michael Behe's "irreducible complexity," physicist David Bohm's "active information," mathematician Marcel Schützenberger's "functional complexity," and my own "complex specified information" are alternate routes to the same reality. The first part of our presentation will consist of building a case that the transitional state attractors are an example of the features of Intelligent Design. Clinical correlation with these principles will also be featured through several live demonstrations of somatic skills and state dependent protocols.

The aim of the first half of the presentation is to make features of nonlinear dynamical systems more observable at the macro-level of interaction. Some of the concepts that will be re-visited will include non-locality, emergence, self-reference, embedding dimensions and the notion of an enformed system (conservation of organization). This will be related to ID model applications.

A Child of Chaos: Applications of Intelligent Design - Part 2
Mark R. Filippi, Private Practice in Larchmont, NY
George Muhs, University of Bridgeport College of Chiropractic

In this half of the presentation, we'll present a case that has been followed applying the somatic and state dependent parameters. A 3-year female with a history of seizures was put through a series of protocols designed to induce the sharing of resources innate to her organism. Data were taken from multiple sessions and correlated with a meta-analysis that revealed a core set of coherent responses was embedded in this child. This confirmed what was anticipated, since referencing prior empirical information generated the protocol.

The conclusion of the presentation will tie back to the Intelligent Design (ID) arguments presented in the first part. This component will focus on ID from a neurophysiological standpoint. A specific application of the 40HZ, or so-called "binding frequency" was explored for its clinical significance relative to subject's cortical-thalamic entrainment. Principles of biological coherence were revealed as the data were explained. The implications for using nonlinear dynamics to study healing patterns was also discussed. In closing, the material reviewed will reveal the topological aspects of applying the principles of nonlinear dynamics to clinical practice as well as other interactive domains. The aim is to add the component of form to the pattern-oriented analysis of dynamical systems that feature a cybernetic environment.

Behavioral Scaffolding and Cognitive Complexity in Autistic Adolescents
Daniel Fienup, Illinois State Universitu
J. Scott Jordan, Illinois State University,
Karla J. Doepke, Illinois State University,
Thomas S. Critchfield, Illinois State University

Cognitive scaffolding refers to the ability to solve problems more effectively by placing parts of a problem-solving activity in the external environment (e.g., arranging a kitchen, using a calendar Clark, 1997, 2002, Vygotsky, 1986). The present paper investigated whether behaviors themselves can serve as problem-solving scaffolds. To test this idea, we asked four autistic adolescents to participate in four separate versions of a short-term memory task (Sternberg, 1966, Kotchoubey & Jordan, 1996). On each of 240 trials, participants indicated yes or no , via a button press, whether or not a presented letter (i.e., the probe) was a member of a previously presented set of letters. We

increased task difficulty across sessions by (1) increasing the number of letters in the memory-set (i.e., 3 vs. 5), and (2) presenting letter sets that formed either words or non-words. We measured cognitive complexity by applying the correlation dimension (Jordan & Brackett, 2002) to the reaction-times series from each session. We measured behavioral scaffolding by coding the presence of engaging and avoidance behaviors on each trial. Collectively, increased cognitive complexity was associated with increases in engaging (i.e., scaffolding) behaviors and decreases in avoidance behaviors. In short, the production of ancillary behaviors increased cognitive performance. References Clark, A. (1997). Being there. Oxford University Press: Cambridge. Clark, A. (2000). Mindware. Oxford University Press: Oxford. Jordan, J. S., & Brackett, D. (2002). Reaction-time complexity varies with accuracy and task difficulty. Paper presented at the Forty-third annual meeting of the Psychonomic Society, Kansas City, Missouri. Sternberg, S. (1966). High speed scanning in human memory, Science, 153-652-654. Kotchoubey, B., Jordan, J. S., Groezinger, B., Westphal, K. P., & Kornhuber, H. H. (1996). Event-related brain potentials in a varied-set memory search task: reconsideration. Psychophysiology, 33, 530-540. Vygotsky, L. S. (1986). Thought and language (translation of 1962 edition). MIT Press.

Facilitating Emergence of Innovative Solutions to Quality Improvement in Healthcare: Creating Actionable System Dynamic Models
Frank Funderburk, In*Compass Systems

Successful healthcare quality improvement efforts involve professionals from a variety of disciplines and organizational levels. Each perspective of the nature, causes, and remediation efforts that are required brings with it a certain degree of face validity, that often makes addressing the concerns through interdisciplinary collaboration difficult to implement. System dynamic models (e.g., Burchill & Kim, 1993; Funderburk, 2004; Sterman, 2001; Wolsterholme, 2003) provide one way of eliciting insight from diverse audiences that can be used to formulate interventions that take into account the various perspectives of those involved in the quality improvement processes. Such efforts, by combining insights from various disciplines and perspectives within a common framework, may identify surprising and counterintuitive effects that might facilitate the transfer of quality improvement innovations into clinical practice. In practice, however, such efforts are often less than optimally effective because the effort needed to construct a limited set of models that will satisfy the needs of diverse audiences are not taken into account. A modeling expert, for example, may require a level of detail that is not consistent with the needs of the front-line healthcare worker or policy analyst. This paper discusses reactions to system dynamic models for healthcare quality improvement in diverse groups of healthcare professionals and offers suggestions for crafting the presentation of these concepts in a way that will encourage the development of actionable models in real life clinical settings.

Experientialism and its Limitations in Whitehead s Metaphysics of Emergence: How the Study of Complex Systems Can Help
Jeffrey Goldstein, Adelphi University

Without a doubt, the most extensive metaphysical system derived from the idea of emergence was that put forward by the British mathematician and philosopher Alfred North Whitehead. Whitehead's fundamental notion of an actual occasion or actual entity was framed according to his emergence-inspired constructs of process and organism. However, lurking in his exposition of process is a reliance on his analysis of the structure of human experience and a consequent generalization from that analysis. In this paper, I will lay out Whitehead's scheme and then offer criticisms of his experientialist stance. Then, I will suggest how the study of emergence in complex systems can help remedy some of the limitations of Whitehead's experientialism.

Electrodermal Arousal between Participants in a Conversation: Autocorrelational and Nonlinear Transfer Effects
Patrick Gunderson, Marquette University
Stephen Guastello, Marquette University
David Pincus, Chapman University

In order to evaluate the role of perceived threat in patterns of interpersonal affective exchange, 37 pairs of college students volunteered to engage in a 10-minute discussion with each other, while connected to electrodes that measured their electrodermal response (ED). Participants were matched on gender and opposing opinions of controversial issues (as reported in a questionnaire administered prior to the interaction) and placed in three groups, where each was asked to 1) convince the other that their viewpoint is correct, 2) listen to the other s opinion and try to

understand, or 3) get to know the other. In addition, participants completed measures assessing interpersonal style. Data analyses were conducted on the time series generated by each of the dyads to determine the extent to which a transfer in arousal rate occurred from one member of the dyad to the other. The linear regression analysis showed a low frequency of transfer, but greater incidents of transfer were detected through the nonlinear regression analysis. The nonlinear models were general exponential structures that determined Lyapunov exponents (and the presence of chaos) from both autocorrelational and transfer sources; Lyapunov exponents were positive for 73 out of 74 participants. The average R2 coefficients were .63 for the linear models, .72 for the nonlinear models without the transfer variable tested, and .67 for the nonlinear models with the transfer variable added. No differences between experimental conflict conditions were noted. Results support the use of nonlinear models for interpersonal transfer effects of this type. Connections between Lyapunov exponent size and Social Skills Inventory variables are now being investigated.

Reuniting Intentionality and Consciousness: An Autocatalytic Approach

J. Scott Jordan, Department of Psychology Illinois State University

Historically, the concept intentionality referred to the apparent directness of human consciousness. Given experimental psychology's turn-of-the-century shift from consciousness to behavior, intentionality is now treated as the pre-specification of motor output, while consciousness is considered a post-stimulus, attention-attenuated perceptual input phenomenon (Jordan, 2003a). In an attempt to reunify consciousness and intentionality, the present paper proposes an alternative approach that is based on data that indicate perception to be just as intentional as action (Jordan, 2003b; Jordan Stork, Knuf, Kerzel & Muesseler, 2002, Kerzel, Jordan & Muesseler, 2001, Jordan & Knoblich, 2004). An alternative approach to intentionality and consciousness is then proposed (Jordan, 2003c), which conceptualizes organisms as self-organizing energy-transformation systems that emerged, phylogenetically, via the struggle for available energy. Such systems are able to sustain themselves (i.e., survive) because they are autocatalytic; their transformation states produce products that feed back into the system as fuel. In addition, such systems are embodiments; their internal transformation states constitute encapsulations (i.e., internalizations) of transformation states that used to exist outside of the organism. Given this notion of autocatalytic embodiment, the following points are argued: (1) such systems are inherently intentional (i.e., end-directed), for the only way they can remain intact (i.e., alive) is via the active, continuous offset of perturbation to the autocatalytic transformation states that sustain them, and (2) the feels traditionally referred to as consciousness, derive from the embedded, embodied, end-directed of-ness inherent in all autocatalytic systems.

Wild Cognitive Systems: An Empirical-Theoretical Integration of Dynamical and Computational Approaches to Mind

J. Scott Jordan, Illinois State University

There currently exists a theoretical rift in cognitive science between computational and dynamical approaches to investigating the mind (Clark, 1997, Kelso, 1995; Thelen, Schoener, Scheier, & Smith, 2002; van Gelder, 1998). At the empirical level this rift expresses itself as different treatments of reaction-time data. The computational approach condenses reaction times into means and standard deviations, and views variability as random noise. In contrast, the dynamical approach views variability as being due to a small number of dynamically interacting factors, and attempts to determine the complexity of the variability (i.e., the number of factors determining the trial-to-trial changes in RTs) (Cooney, 1998: Cooney & Troyer, 1994). During my talk I will present theory and data that indicate the two approaches can be integrated if one assumes that streams of reaction times should be complex (as opposed to simple). Given that the real world is highly complex, moment-to-moment changes in performance should be complex. That is, successful cognitive agents should be wild.

On some Measures of Complexity and Variability of Cardiovascular Data

Roumyana Kirova, Marquette University
Peter Tonellato, Medical College of Wisconsin

We apply two different methods to analyze the variability of experimental blood pressure and heart rate recordings from genetically distinctive populations of inbred rats and human large pedigrees. First we assume that the signal is generated by a chaotic deterministic system and use symbolic dynamics to measure its complexity through well known quantities, such as the entropy, Renyi dimension, and mutual information. We analyze several choices of Markov partitions and study the corresponding symbolic dynamical systems: partitions into equal-size data intervals and partitions into intervals aligned with the sample moments of the data. In the next approach, the signal is interpreted as a realization of a discrete Markov chain. The mechanistic properties of the signal are naturally characterized in terms of some classical and new concepts from Markov chain and weighted graph theory. We introduce Cheeger type quantities as measures of local variability due to biological feedback mechanisms. We study the statistical properties of the estimators and their relation with global properties of the system. In a case of vector

models, we use decomposition methods to analyze the global behavior of the system. The measures from both approaches can be coupled with genetic information and used in further statistical linkage analysis.

Correlation Dimension Estimates of Extended Mood Time Series in Health and Bipolar Disorder using Wireless Handheld Data Collection

David Kreindler, Department of Psychiatry, Sunnybrook & Women s College Health Sciences Centre
Anthony Levitt, Department of Psychiatry, Sunnybrook & Women s College Health Sciences Centre
Charles Lumsden, Institute of Medical Science and Department of Medicine, University of Toronto

Introduction: Claims have been made that human mood in bipolar disorder can be characterized as a low-dimensional chaotic process; however, significant methodological problems have so far complicated efforts to test this hypothesis. We examined the usefulness of the correlation dimension (CD) to distinguish between healthy and pathological mood records collected using more robust methods. Method: Self-report ratings of mood symptoms were collected using a 19-item visual-analog-scale-based questionnaire (the VMQ) administered twice daily over eighteen months from (n=20) individuals with rapidly cycling bipolar disorder and (n=20) healthy controls using wireless-enabled handheld computers. Ratings were automatically time-stamped and transmitted via wireless e-mail to document accurately when each report was generated. Estimates of correlation dimensions were calculated for four VMQ items: bipolar mood, a standard measure of mood; fatigue, a sensitive indicator of illness; anxiety, a frequently co-morbid symptom; and a control item, estimated hours of daylight. Results: Participants average response rate was 84% over the 18-month interval, with an 88% subject-retention rate. Surrogate data tests indicated that CDs could be robustly estimated for time series inflected by these response rates. Normal-bipolar CD differences were detected for all scales assessed, with lower CD values favored in the bipolar subject data. *Contact author. **Project Principal Investigator. Conclusion: CD estimators apply to diverse measures of normal and bipolar mood dynamics in natural settings; however, for normal subjects especially, over-reliance on the CD may mask evidence of key alternative nonlinear mechanisms, such as the self-organization of mood change into critical states free of a single, dominant time scale for mood change.

A Cusp Catastrophe Model of College Student Alcohol Use

Kelly Kulkoski, Dept. of Psychology, Marquette University, Milwaukee, WI
Stephen Guastello, Dept. of Psychology, Marquette University

Excessive alcohol use and binge drinking among college students are health risk behaviors of considerable concern. The Theory of Reasoned Action (TRA) represents a model that has been widely used to examine the influence of attitudes and subjective norm (i.e., peer pressure) on students' intentions to drink along with actual drinking behavior. Nonetheless, primary weaknesses of this model include the relatively limited amount of variance generally explained and the model's limited ability to account for complex behavioral patterns that may emerge when attitudes and peer pressure interact. An intriguing new line of research emerging from the field of nonlinear dynamics is offering to extend our understanding of this behavior. Preliminary findings in the literature suggest that cusp catastrophe modeling may offer a more sophisticated method for understanding students' substance use behavior by accounting for nonlinear relationships between substance use and two of the primary factors shown to influence this behavior in adolescents and young adults' attitudes and peer pressure. Using data collected on 1,197 undergraduates who completed the Core Alcohol and Drug Survey, this presentation will discuss the findings of a recent study that examined the effectiveness of a cusp catastrophe in modeling student alcohol use. Analyses revealed that the cusp catastrophe is superior to alternative linear models in explaining both binge drinking and frequency of consumption. Further, findings suggest that the cusp catastrophe may be a particularly powerful model for explaining substance use in college males.

Perturbation theory: A quantum model of organizations, classical information, and perturbations

William Lawless, Paine College

One motivation to apply quantum mathematics to social theory is that information, I, derived from methodological individualism (Nowak & Sigmund, 2004) does not sum to recreate groups at either social (Levine & Moreland, 1998) or atomic levels (Zeilinger, 1999). In addition, Heisenberg (1958) applied his uncertainty relations to social interaction, Penrose (Hagan et al., 2002) applied them to neurological interaction, and Luce (1997) applied the quantum to satisfactorily model signal detection. However, our justifications for applying quantum theory to social theory are

three-fold: first, it replaces game theory logic faulted by Luce and Raiffa (1967) as unworkable with a physics of organizations, an alternative traceable to Lewin (1951); second, it predicts that measuring organizations always produces classical I (Lawless & Grayson, 2004), resolving the major unsolved social problem of shifts between individuals and groups (Allport, 1962), establishing the individual as an artifact of measurement; and finally, it affords a mathematical theory of organizations as the source of exogenous I to its attackers and endogenous I to its defenders, the physics of perturbation feedback replacing the limited and normative control system belief that organizations only require stability after disturbances. Our major findings are controversial: that under conditions of stability, competition increases social evolution; that under instability, cooperation improves social welfare by enforcing groupthink; and that extreme forms of cooperation increase corruption and provide cover for terrorism. Moreover, envisioning conflict as the driver that evolves society by forcing superposed neutrals to search through random explorations of problem spaces opens new avenues of research. Acknowledgements. The lead author thanks J.A. Ballas ITD, NRL, Washington, DC, where most of this research was conducted with funds from ONR through an ASEE grant.

Analysis of Creation and Operation of Two Schools based on Theory of Chaos

Krystyna Laycraft, Equilibrium International Education Institute

In this paper the concepts of the chaos theory: bifurcation and amplification, nonlinearity, negative and positive feedback, and attractors are used to explain the creation and operation of two different schools. Polish and Canadian scenarios are compared. As one's creation was chaotic the other's was serene and calm. The process of creation of Polish School was dynamic and complex under the influences of different types of attractors. It encountered "bifurcation points" that were leading to different futures. It arose from a coupling of feedback springing from random individual activity. It was shown that when diverse individuals self-organize, they were able to create highly adaptable and resilient organization. High-leverage initiatives that could trigger a transition from one attractor to another, the problem of "resistance" contra "new attractor", the challenge of maintaining stability and changes were illustrated. The process of positive and negative feedback were broadly analyzed based on examples of Canadian School. The paper ends with a discussion on simplicity / complexity and the role of intermittency in lives of schools.

Arrival Times of E-mail Viruses Provide Information about the Structure and Dynamics of the Internet

Larry S. Liebovitch, Florida Atlantic Univ., Naval Res. Lab

We analyzed the times between the arrival of the AnnaKournikova, Magistr, Klez, and Sircam e-mail viruses into the network of an Internet Service Provider in the United Kingdom. We found that there was a power law distribution t^(-alpha) in the times between the arrivals of each virus with 1.5 < alpha < 3.2. We also found that these times were correlated. The Hurst exponent H, which measures fractal correlations, was 0.80 < H < 0.86, where H = 0.5 would indicate that the times were uncorrelated. This correlation is surprising since the viruses arrive, independently, from different computers. We could produce such power law distributions and correlations by a model where n(k) computers send e(k) viruses separated by t(k) units of time. When both the structure (n), and the dynamics (e, t) have power law scalings, namely n(k) = k^(-a), e(k) = k^(b), and t(k) = k^(-c), then there is a power law distribution with alpha = 1-a/c+b/c in the times between the arrival of each type of virus and these times are correlated with H > 0.5. Thus, these e-mail viruses provide an interesting way to probe the interaction between the structure and dynamics of the Internet. This interaction between structure and dynamics is also important in understanding the operation of other electronic, biological, or social networks.

HELP WANTED: Randomly Typing Monkeys (Determinism Need Not Apply)

Patricia Lipscomb, Psychiatrist & Psychoanalyst, Private Practice, WA

It is a commonplace that, under certain conditions, deterministic processes lead to patterns that seem to jump out from a background of apparent randomness. Given that we can even build in a role for randomness in the production of visible pattern (as in versions of the chaos game), it might appear that determinism is critical for pattern formation when random factors are involved. However, it is readily demonstrable that, for any infinitely long random sequence of symbols from set X, any arbitrarily given finite sequence of elements of X will appear in the random sequence with probability 1. This result severs the notion of pattern within apparent or actual randomness from any requirement that determinism be at work and invites us to reexamine our intuitive sense of the nature of randomness, to question the applicability of the Law of the Excluded Middle to infinite sets, and to reconsider the implications of the unexpected appearance of pattern.

Genuine communication as synchronization between chaotic human systems
Peter Malling, Institute of Organisation and Management, University of Southern Denmark

In successful, innovative teamwork, the team members will at certain points experience that their minds converge, paving the way for crystallization of new ideas and concepts. This phenomenon involves a shift from tube communication between separate minds to genuine communication , in which the involved minds co-evolve, co-creating shared mental models. Especially in the early phases of innovative teamwork, it is crucial that the divergent thinking patterns of the team members converge into this kind of synergetic, shared cognition. The emergence of mind from brain activity in the individual person can be explained as a chaotic process. Hence, the phenomenon of innovative crystallization can be understood as synchronized coupling between two or more chaotic systems. I propose that in order to predict whether innovative crystallization in certain team constellations is likely to occur, we should use complex, dynamic and multivariate models appropriate for predicting the behavior of chaotic systems, rather than simple, cause-effect models based on identification of linear dependency between single or multiple variables, which has been a prevalent approach in team research.

Coherence, Learning, and Communication: A Dynamical Perspective
Jermaine Martinez, Illinois State University

Theories of learning are often committed to correspondence models of learning. Simply stated, the correspondence model holds that learning is a process of communicative transmission, or information acquisition. Moreover, given this view, the mind is conceived as a computational information processor. These two notions work together to vitalize pursuits of lesson planning and curriculum design that strive earnestly to create clear, unambiguous, and engaging communication with students. Somewhat in response to these trends, however, this paper argues for a coherence model of learning. The coherence model holds that learning is a process of transformation, or self-organization. The coherence view points attention to the embedded character of organisms and the significance of ambiguity in the experience of learning. Drawing from biological theory and cognitive science, we first elaborate the character and dynamics of a coherence view of organisms and their world. Then, we present a case study of past research that have wittingly, or unwittingly, employed coherence principles in their studies of learning behavior. Finally, we respond to critiques of the coherence model and offer suggestions for communication education.

The Web And The Cloth: Science, Consciousness And Homeodynamics, What They Are And What They Do
Daniel Miller, Greenwich University, CA; Licensed Psychologist, Private Practice, Brooklyn, NY

Unifunctional consciousness attempts to explain the integrated activity of body, mind and spirit by taking us beyond holism into the mechanisms of integration. The search to understand and bridge the gap between differences in consciousness described in psychotherapy, science, and everyday life brings us to perceiving Homeodynamics as the mechanism of unification. Homeodynamics is a relatively new concept that explains how the driving force behind interactions among systems is the optimization of their relationships in the interests of each system's survival, under ideal conditions. It is a broadly based concept that enters into the realm of the sciences through astronomy, physic, biology and evolution, and into studies in phenomenology and psychology through psychotherapy and neuropsychology. To find a way to bridge the very diverse fields of scientific and phenomenological research, we must attempt to understand the operation of consciousness as a tool of research within its many diverse forms. In this approach, consciousness views its subject matter through the kaleidoscope of complex systems theory. Homeodynamics, implementing a survival mandate, is therefore able to provide a common baseline for the unification of mind, body and spirit in the complexly interactive functions of science and unifunctional consciousness.

Engagement as a nonlinear function in the worker/client relationship
Kathleen Moffett-Durrett, Social worker

A Theory for Client Contact: Nonlinearity and Engagement The author's interests lie in theory development and application of knowledge to affect services provided to social work clients at all levels of intervention, accounting for the cultural and environmental milieu within which people exist and within which practice must be effected. An attempt will be made to develop a loose formulary field within which the practitioner can gauge the interactive process to judge for appropriateness and potential effectiveness. The focus will be to create a communicative milieu within which the singular experience of the individual client can be examined. It is assumed that patterns, which can be discovered within the matrix of that person's life [or institution's history], can be explored for alternate interpretations and methods of adapting that lead to positive social change. The exploratory vehicle, for this presentation, will be perceptions of engagement. It is my perception that engagement is an elusive and poorly operationalized concept--frequently cited as though understanding and concurrence are consensual. Social workers and homeless persons will

have an opportunity to develop a history which will explore iterative patterns of prior events and current responses and perceptions of "engagement". From this material a functional definition of engagement will be offered and an operational format for identifying it as a tool for attainment of client goals will be developed.

One bad apple...An experimental test of the impact of intrapersonal conflict on the complexity of group dynamics

David Pincus, Chapman University

Four female undergraduates participated in a series of four 30-minute unstructured discussions (d1 to d4) separated by ten-minute breaks to fill out questionnaires assessing closeness, conflict and control for each other member. Intrapersonal conflict was induced between d2 and d3 through false-feedback to one member regarding her scores on closeness and conflict. Results showed stable complexity in verbal turn-taking dynamics across d1 and d2 respectively based on Shannon Entropy (Hs = 5.54 & 5.56), fractal dimension (Df = 2.25 & 2.47) and a $^{3}2$ test of structured patterning across d1 & d2 (Chi-2= .163, p = .983). Patterning increased significantly after the experimental induction (Chi-2= 64.2, p < .001, from d2 to d3) as entropy decreased, and then remained low during d4 (Hs = 5.16 & 5.06; Df = 1.46 & 1.21). Values for topological entropy and Lyapunov dimension remained relatively stable across all four discussions, ranging from 1.3 to 1.0. However, the length of the longest proximal recurrence increased from six-utterances in a row in d1 and d2 to ten in d3 and d4. The results suggest that individual conflict can make group dynamics more rigid. Implications for conference themes of surprise and paradox will be discussed including the fuzzy notion of the group within the member; the co-mingling of pattern and turbulence in small-group evolution; and the putative role of conflict in both stasis and growth, both within and among individuals.

The Rise and Fall of Catastrophe Theory Applications in Economics: Was the Baby Thrown out with the Bathwater?

Barkley Rosser, James Madison University

This paper presents an overview of the theory and history of catastrophe theory and reviews a variety of applications of it in economics. Then the debate over it is recounted, with especial emphasis on misleading arguments made regarding the famous paper by Zeeman on stock market dynamics. More recent alternatives to it are considered with the observation that it is making a come back in some of these approaches.

Applications of Catastrophe Theory to Science Education

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

The current study examines the applicability and usefulness of catastrophe theory in education. Conventional approaches to data analysis in education research have treated students' achievements as errors around the mean, and this has limited statistical modeling in education. Our experience has shown that very seldom we get normal or even unimodal probability functions, and this is strong evidence for the existence of fundamentally nonlinear underlying stochastic processes. These processes involve interactions among subjects' mental resources and mental tasks. In the last decades, many researchers in Science Education have based their models on neo-Piagetian theories, where certain variables / constructive operators, such as M-operator (information processing capacity), L-operator (logical operations) or F-operator (degree of field dependence-independence) have been shown to be predictive of the students' performance. These linear models were based on reductionism and they have limited our understanding on the role of each operator. The current study proposes catastrophe theory models to show how these operators, which actually represent processes, could interact with each other in a nonlinear fashion and cause discontinuities in students' performance. Empirical evidence is provided for a stochastic cusp catastrophe model in problem solving. The data were achievement scores of freshmen at a technological college. Measurements were taken at two points in time and the data analysis involved dynamic difference equations and statistical regression techniques. The theory-driven hypotheses, which were tested, intend to build bridges between NDS-theory concepts and neo-Piagetian theories applied to education. This study sets a framework for the application of catastrophe theory in science education.

Is Corfu Airport at the Edge of Chaos?

Dimitrios Stamovlasis, Education Research Center, Athens, Greece
Antonios Bakolis, Corfu Airport, Corfu, Greece

An airport is a complex system comprised by interacting components, which cooperatively lead to the overall performance. The hypothesis in this work was that an airport could be viewed as a self-organized, complex living system with nonlinear characteristics that could be performing at the edge of chaos. We tested this hypothesis and we present empirical results from a preliminary study aiming to reveal the dynamical characteristics of the process underlying the functioning of an airport. Data were taking from the busy airport of Corfu island. The output variable in this study was the time delay between scheduled and actual time of flights. This delay could be considered as the response time (RT) of our system and it was treated as biosignal . Two time series (N=4271) were recorded and analyzed: One for arrivals and one for departures. Singular value decomposition (SVD) procedure was used to remove noise from the raw data. The analysis consisted of attractors reconstruction, calculation of dimensionality, correlation dimension, Lyapunov exponent, power spectrum, and 1/f dynamical characteristics. The null hypothesis was tested with the surrogate method. The results showed different nonlinear characteristics between the departure and the arrival RT time series. Departure-RT demonstrated low dimensionality, self-similarity and characteristics of pink noise, while arrival-RT seemed to possess random character. The findings could spark insights into self-organization of this type of system and could motivate further investigations.

Horizontal Emergents in Archetypal Dynamics
William Sulis, McMaster University

Archetypal dynamics is concerned with the study of the flow of meaning laden information in complex systems and the study of emergence. In archetypal dynamics, a complex system is one which realizes multiple independent semantic frames. Tapestries, as representations of systems, are therefore complex if they can be interpreted by multiple independent semantic frames. In the case of tapestries admitting only two distinct meaning laden relations, several theorems are presented to determine when such a tapestry is complex. Several counter examples are presented. Examples are presented in the case of three relations to show where the two relations case fails to generalize. Implications for the study of horizontal emergents and emergence will be presented.

Sexual Abuse Throughout Generations - A Selforganizing Process
Karl Toifl, Medical University of Vienna; Neuropsychiatric Clinic for Children and Adolescents
Heidrun Eichberger, Medical University of Vienna, Neuropsychiatric Clinic for Children and Adolescents,
Sylvia Völkl, Medical University of Vienna; Neuropsychiatric Clinic for Children and Adolescents

This workshop should: give a short information about sexual abuse data in general demonstrate by using a typical individual case report, how abusing patterns are transmitted throughout generations explain, how the transmission of pattern - information could be stopped by therapeutic intervention demonstrate a combind model of quantitative and qualitative methods to investigate such selforganizing processes

FAST and the Arms Race: A nonlinear evaluation of the Families and Schools Together Program
Keith Warren, The Ohio State University
Paul Moberg, The University of Wisconsin-Madison
Lynn McDonald, The University of Wisconsin-Madison

Theory: Several decades research suggests that pre-school and elementary school children, particularly in inner cities, learn aggressive behavior from peers through negative reinforcement; those children who retaliate against aggressors are less likely to be targets of aggression, but more likely to become aggressive and delinquent themselves. These children become trapped in an arms race, forced to respond to aggressive peers who are, in turn, forced to respond to them. In the Families and Schools Together (FAST) program, children interact in the presence of their parents. This should alter the interpersonal dynamic. Methods: Inner-city Milwaukee classrooms were randomly assigned to either FAST or a control condition. Group level data was analyzed. Teacher ratings of aggressive behavior at baseline were used as predictors of parent ratings of aggressive and delinquent behavior at one-year followup. Because arms race models lead to nonlinearity in data, loess regression was used for analysis. Model fit was compared using the ratio of the variance of the residuals, which yields an F distribution. Results: Loess regression indicated nonlinearity. Teacher ratings of aggression explained 22% of the variance in parent ratings of

aggression in the FAST groups and 60% of the variance in the control groups (F = 1.71, p = .086). Teacher ratings of aggression explained 23% of the variance in parent ratings of delinquency in the FAST groups and 73% in the control groups (F = 2.30, p = .018). Implications: This study suggests that nonlinear analysis may be useful in evaluating complex programs such as FAST.

A Sudden Decision: Variability in suicidality in multiple, single and non- suicide attempters

Tracy Kathleen Witte, Florida State University
Kathleen Kara Fitzpatrick, The Ohio State University
Keith Warren, The Ohio State University
Norman Bradley Schmidt, Florida State University

Purpose: There has been no study of the daily variability of suicidality, even though suicide itself often comes as a surprise to clinicians. This study tests two hypotheses, first, that daily variability in suicidality is significantly different from zero regardless of history of suicide attempts, and second, that individuals with multiple previous suicide attempts show increased variability in suicidality. Methodology: Sixty-eight university undergraduates kept daily suicidality ratings on the Suicide Probability Scale (SPS) a 36-item, self-report measure of attitudes and behaviors related to suicide risk for periods of five or six weeks. Logarithms of the Mean Squared Successive Differences (MSSD) of the daily scores were used as a measure of the variability of suicidality. Participants also kept daily scores on the Beck Hopelessness Scale (BHS) and the Beck Depression inventory (BDI) and reported previous attempt status. The difference of the logarithms of SPS MSSD scores from zero was analyzed using a 95% confidence interval, while the ability of previous attempt status to predict the logarithm of SPS MSSD was analyzed using multiple regression. Results: The logarithm of SPS MSSD was significantly greater than zero regardless of previous suicide attempt history. Regression analysis indicated that attempt history was a significant predictor of the logarithm of SPS MSSD while controlling for number of days in the study, and mean BHS and mean BDI during the study. Implications: This study demonstrates daily variability in suicidality and its association with multiple attempt status, and suggests that further modeling of this variability is warranted.

Strange Attractors and Fractals in Theistic Philosophy

Chad Webb, Department of Psychology, Pikeville College, Pikeville, KY

Philosophy, as a whole, is notorious for progressing arguments of meta-questions in particular fields of thought not to a logical and unilaterally agreed upon conclusion, but to yet another apparent paradox. More often than not, this new paradox is even more head-swimming and convoluted than the previous one. It seems apparent solutions to problems of logic and perspective are tentative at best, for historically all have fallen prey to some sort of serious reservations upon further review and new insight. Here we see a classic case of a linear progression (i.e. deductive and inductive reasoning) becoming analinear in nature due to some unforeseen aspect pulling the argument back upon itself. Theistic philosophy is not immune from this fate in the slightest. In fact, some would contend it would be further subject to an overtly complex nature due to its inherently ineffable subject matter, the notion and nature of God. My paper and presentation are going to try to examine that very notion. Drawing from some of the major arguments within the field, such as The Problem of Evil, the argument for the infinite nature of God, and the argument of God's existence, I will attempt to convey my observations on their paradoxical conclusions, and demonstrate how structurally these arguments have yet unseen strange attractors that are driving self-iteration. Also, through an examination of the underlying assumptions and motifs of the arguments, I will attempt to display a fractal-like nature due to their literal self-similarity at multiple levels of inquiry.

Chaos Theory, Brain Patterns, And Personality Attributes

Rita Weinberg, Psychology, National Louis University

This paper is a study of chaos theory, brain patterns and personality attributes, with special focus on how perceptual-motor systems are organized to reflect personality traits.. Personality is a complex system of traits or variables which appear to develop patterns or habits of behaviors and emotional responses which provide adaptive functions for individuals within the systems in which they operate The focus is on one domain in particular: the perceptual-motor domain and how its patterns manifest themselves. Like other complex systems, they are rather stable unless something occurs to destabilize the system. Then the pattern shifts. When an occurance such as a trauma is very extreme, all patterns or reactions stop or become chaotic. One indicator of the severity of the impact of some experience is not only a pattern shift but also how successfully patterns re-establish themselves. Trauma could disorganize and break apart the existing system. The perceptual-motor aspect of our personality systems is a fractal of the overall system. The examples used here reflect how the system shifts, how these factors are discerned in the manner of execution of a visual-motor task (Bender Gestalt Visual-Motor Test). We also show evidence of pattern recovery or lack of recovery. These exercises involve having a subject copy a simple series of geometric figures onto

a sheet of paper. The paper explores initial conditions and brain-personality patterns as they appear in an exercise where there is no language or words or creative drawings but simply a visual/perceptual motor task. The response reflects fractically personality attributes.

Chaos Theory, Brain Processing, and Paradoxical Thinking
Rita Weinberg, Psychology, National-Louis University

Chaos theory facilitates our understanding of how our systems operate, including how the brain processes information.. When new information enters the brain, the majority of individuals sorts for where and how that new information matches what we already know and understand. For a smaller segment of the population the sorting of information seems to process by search for differences or omissions rather than matches. This appears to be part of a meta-cognitive system of the brain which characterizes paradoxical thinkers. Their thinking is also reflected in the way they communicate. They talk about what is not there or about what is missing. They frequently use the terms Yes, but , or This is not there or except that Their brain processing system turns the focus on the exceptions or gaps in what they hear. . The systems of paradoxical thinkers may have developed their systems at an early developmental stage. .Some might have incorporated such paradoxes into their thinking as a protection against overlooking something important and thus being ashamed of their performance. Another initial condition concerns those who are taught, as adolescents or young adults to use paradox processing as part of their training as in the sciences or other domains. There it would be important not to overlook omissions when examining data. One problem with paradoxical thinkers is that their system of communicating and the non-paradoxical system communicators These communication systems do not operate synchronistically. Although paradoxical individuals are often seen as negative or obstructionist, we believe that this is a part of their organized system of processing information.. Complex systems such as the brain can have stable parts which function in a very systematic way. When two complex systems interact, such as matchers and paradoxers, their interactions may not be smooth. To be more effective, we must look to utilizing the very systems in which they operate.. This paper will look at additional ways to understand paradoxical thinking as a neta-system pattern phenomenon and indicate how non-paradoxical thinkers can communicate more effectively with those who think paradoxically...

KEYNOTE SPEAKERS

Lessons for Life from the Newest Science
Raima Larter

The natural world as revealed by the newest science chaos theory, or, more properly, nonlinear science holds deep and profound lessons for how we should live our lives, both individually and collectively. Concepts drawn from this science provide a series of lessons that can be applied to our lives, both individual and collective, as we confront change in our world. In my recent book, Life Lessons from the Newest Science, I describe six such lessons involving the key concepts of cycles and rhythms, the attractor, bifurcation, chaos, self-organization and fractals and show how real "help for what ails us" can be found in these concepts. In my talk I will first briefly review my earlier research in chemical chaos and its application to the dynamical disease of epilepsy before turning to an elaboration of the ideas discussed in this book. Consider, for example, the key concept of bifurcation. The name, taken literally, means a "fork in the road" has been reached and we sense -- quite rightly -- that the way we were living our lives before the bifurcation occurred is no longer appropriate. This is the way growth really occurs it is much more akin to metamorphosis than the smooth, gradual change most people wish for. The terrorist attacks of September 11 provide a recent global example of a bifurcation, one of the most difficult of the lessons to cope with. This type of transition occurs every day in our personal lives, often triggered by a catastrophic event such as a death, diagnosis of illness, or, on a happier note, the sudden change in role that occurs with the birth of a child. Another of the key concepts from nonlinear science, the attractor, provides a solution for coping with such changes since a bifurcation, while associated with the death of one attractor, always results in the birth of a new one. The insights from the newest of sciences, Emergence, provides, then, lessons that are much needed by both individuals facing personal catastrophes and leaders struggling to cope with a world that is changing in puzzling and unexpected ways.

Options for Action: Paradox and Surprise in Human Systems Dynamics
Glenda Eoyang

The complex dynamics of human systems are an endless source of paradox and surprise. In this presentation, Dr. Glenda Eoyang will focus on self-organizing in human systems--the paradoxes that drive them and their surprising results. Through stories, theoretical frameworks, and questions you will apply the emerging principles of human systems dynamics to explore individual and group options for action in relationships, professional life, and SCTPLS. The talk will address the following questions: - What are the patterns of paradox and surprise that shape the landscape for research and action in the field of human systems dynamics? - What conditions shape self-organizing processes? - What are the roles of leader and researcher in human systems as they self-organize? - How can we use these insights to enhance our shared inquiry in SCTPLS?

The Chaos and Complexity of Classic Hollywood Cinema
Michael Gillespie

In a book that I published last year, *The Aesthetics of Chaos*, I offered the argument that features of chaos and complexity theories were particularly suited to interpreting literature. Unlike literary critics who have attempted to apply these concepts to their field, my aim was not a strict translation of the principles into my area. Rather, I felt that chaos and complexity could serve admirably to break down the restrictive cause and effect approach to interpretation that dominates my field, and I felt also that specific concepts, albeit sometimes loosely related to chaos and complexity-Heisenberg's uncertainty theory, Schrodinger's Cat, scaling, fractal basins-could provide metaphors for thinking in a nonlinear fashion. I would like in this talk to apply that same approach to film.

Nothing seems more conventional or predictable than the formulaic patterns of classic Hollywood cinema. No matter what the genre one finds the structure of the plot organized around a specific problem, the character development related to that problem, and the narrative driven by efforts to resolve that problem. However, the best films in the classic Hollywood cinema mode resist the linearity of this pattern. I will related in a general fashion how elements of chaos and complexity provide new metaphors and consequently new interpretive approaches for engaging classic Hollywood cinema. Then I will look at a film clips from a series of representative genres-the Western, Gangster films, Film noir, and Comedy-to illustrate how nonlinear thinking enriches the interpretive experience for this ostensively very traditional mode. Some of the films that I will consider are *High Noon*, *The Untouchables*, *Double Indemnity*, *His Girl Friday*, and *Some Like It Hot*.