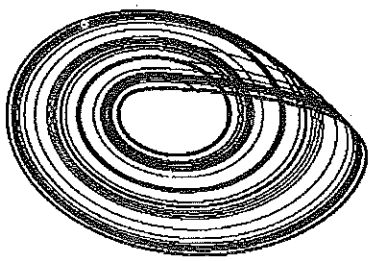


SOCIETY FOR CHAOS THEORY IN PSYCHOLOGY & LIFE SCIENCES

NEWSLETTER

▪ VOL. 15, NO. 3, APRIL 2008 ▪

IVELISSE LAZZARINI, PRESIDENT

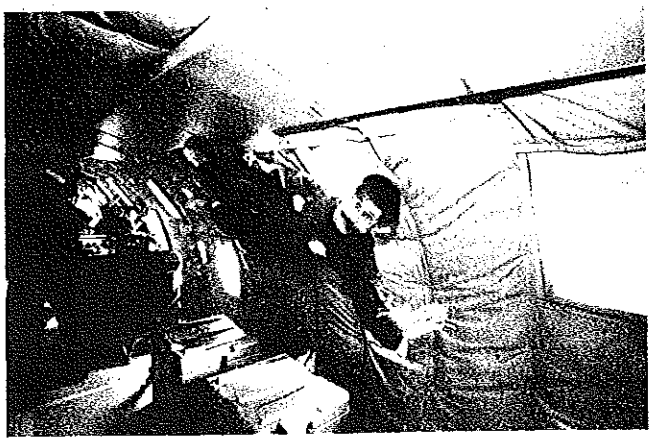
SARA ROSS, EDITOR ▪ STEPHEN GUASTELLO, PRODUCTION EDITOR

TABLE OF CONTENTS

▪ NEWSLETTER SUBMISSIONS: SARA.NORA.ROSS@GMAIL.COM ▪

Conference Lift-off Workshops Announced!

Three exciting workshops will launch our August 2008 conference in Richmond, Virginia. These are enjoyed on the first day of the conference, preceding its evening Sunset Session with guest speaker. Below are pre-lift off appetite-teasers!



This snapshot of one of our special guest speakers, Mark Shelhamer, captures the elevated tone of our excitement about this conference!

Introduction to Fractals and Chaos

Facilitator Larry S. Liebovitch, Ph.D. is a Professor and the Graduate Program Director of the Charles E. Schmidt College of Science, and former Director of the Center for Complex Systems and Brain Sciences at Florida Atlantic University. He has used nonlinear methods, including fractals, chaos, and neural networks to study genetic regulatory networks, the spread of biological and electronic infections, motions in proteins, the timing of heart attacks, and the swimming of one-celled organisms. He is the author or co-author of 2 books, 22 book chapters, 72 journal articles, and has given presentations in the U.S., Belgium, Brazil, Canada, China, Denmark, Finland, France, Germany, Hungary, Israel, Poland, and Sweden.

This workshop will present an introduction to fractals and chaos and their applications in a way that even those with a limited background in mathematics can understand. Topics covered will include : (1) Fractals: Introduction, Self-Similarity, Scaling, Dimension, Statistical Properties, (2) Chaos: Introduction, Phase Space, Sensitivity to Initial Conditions, Bifurcations, Analyzing Data, and Control of Chaos. The presentation will be based on the book, Fractals and Chaos Simplified for the Life Sciences, by L. S. Liebovitch, Oxford University Press, 1998 and the CD-ROM The Mathematics and Science of Fractals by L. S. Liebovitch and L. A. Shehadeh, Deco Bytes Education (www.decobytes.com).

Testing Hypotheses for Nonlinear Dynamics with Popular Statistical Software

Facilitator Stephen J. Guastello, Ph.D. is a Professor of Psychology at Marquette University, Milwaukee, WI, where he specializes in industrial-organizational psychology and human factors engineering. He received his degrees in Psychology from The Johns Hopkins University, Washington University (St. Louis), and the Illinois Institute of Technology. He has written three books and over 100 journal articles and book chapters on various topics in psychology, most of which involve nonlinear dynamics. He is a past president of SCTPLS and currently editor in chief of its research journal, *Nonlinear Dynamics, Psychology, and Life Sciences.*

This workshop explains how hypotheses concerning catastrophe models, chaos, and related attractor dynamics can be tested statistically using SPSS or similar statistical software. The analytic techniques involve the polynomial extensions of the general linear model and nonlinear regression. Examples from published works on topics such as mental fatigue, leadership, population growth, personnel selection and performance, and economic inflation will be considered among other topics. This workshop is intended for participants who are familiar with the general linear statistical model and who are now ready to move forward.

The workshop is organized into six themes: (1) The statistical properties of measurements in a nonlinear process. (2) The properties of exponential distributions, power law distributions, and the interpretation thereof. (3) Catastrophe models for discontinuous change processes, which are extensions of the general linear model. (4) The properties of nonlinear regression and how it can be used to specify and test any nonlinear hypothesis, including how to find a Lyapunov exponent and a fractal dimension. (5) The exponential series for continuous change processes, such as attractor dynamics, oscillations, and the presence of chaos. (6) As time permits, the foregoing principles will be extended to cover static representations of dynamical processes and linkage (or slaving effects) in self-organizing systems. The goal in each module is to provide participants with a step by step procedure for accomplishing their analytic objectives.

CHAOS, Inc.™ Learning Laboratory

Facilitators John Winthrop Link and Jo Lee Loveland Link and their firm, VOLVOX, Inc., have sustained interest in applying concepts of chaos and complexity to social systems since the Links first became intrigued, together, about the world of emerging "new sciences." For the past 20 years, the Links have had opportunities to examine and explore those concepts up close in practice with real-world organizations – large complex government systems, mission-critical defense systems, emerging Information Technology initiatives in large-scale Net-Centric web-based knowledge management, intelligence community efforts to bring information sharing to high velocity while struggling to maintain security, etc. "Management of complex change" takes on new meaning in efforts with cross-enterprise integration of previously disconnected, uncoordinated, and often (sometimes covertly) competitive organizations.

CHAOS, Inc.™ is an original improvisational game that applies chaos and complexity insights to real-world social/ organizational systems. Together with participants, we co-create and enter an environment of collaborative learning and exploration. Workshop participants enter a well-defined simulated "company," and begin work. The "company" then is subjected to events and pressures typical in contemporary organizations – i.e., never the same twice. Participants face multiple dilemmas. Mid-way in the exercise, "company" members have an opportunity for organizational redesign. All are challenged and invited to reinvent their organization. Then, in a "work restart," participants can test their new strategies, assets, approaches, and learning that may be leveraged "back home."

Unlike most workshops or training -- but just like real-world organizations (one participant said: "What's really hard about this exercise for me is...it's just like my real job!) – CHAOS, Inc. ™ is a true experiential laboratory, designed for everyone from beginners through those with more advanced understanding. Again, just as in real life, we learn from one another. People from different levels of knowledge and experience create dynamic creative friction – and we are all made richer by the mix. CHAOS Inc.™ produces every time outcomes and insights that are intriguing, diverse, and mirror emerging dynamics. We hope that you will come to play, explore, experiment, and learn with us!

Special Guest Conference Speakers Announced for SCTPLS 18th Annual Conference 2008

Deborah J. Aks & Mark Shelhammer

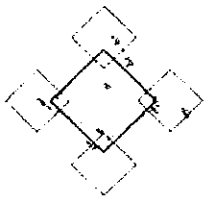
Studying the Dynamics of Visual Search as a Window on Perceptual-Cognitive Behavior

Deborah J. Aks, Ph.D. received her doctoral degree from the University of British Columbia in 1993. She is a Research Associate Professor at Rutgers University. She has studied a range of topics in visual perception including the interaction of apparent depth with perceived size. She has also spent much time learning DS analytical techniques, and thinking about applications to various perceptual phenomena including visual search and ambiguous stimuli. She has become increasingly convinced that to understand perception we need to explore how the process unfolds and changes over time.

Presentation Abstract

The coordination of perception and cognition is intimately tied to people's interactions with their surrounding environment. This dynamic plays a crucial role in accounting for how incoming sensory information integrates with prior experience, and gives rise to efficient functioning in the real world. Critical to understanding such complex systems is the need to learn how behavioral patterns evolve over time, are time-dependent, and how they scale with surrounding context. Also essential is the need to determine the role that internal states and external conditions contribute to these behavioral patterns.

Using visual search as a working example, I will discuss how dynamical systems theory and its tools can help us better understand the complex interplay between mental-behavioral-environmental systems. Specifically, I will describe how scan-paths can be used to assess patterns of correlation across a series of eye-movements. Results from various search tasks show scaling and long-range (1/f) trends across a diverse set of conditions. When display structure is altered, subtle but reliable shifts occur in search patterns: Extrinsic structure either attenuates or enhances intrinsic processes depending on which serves as the better guide to search. Despite these display-induced shifts, 1/f patterns were surprisingly pervasive across conditions suggesting a common, but highly variable, scanning strategy is used by most people across many different search settings. That this pattern occurs across the sequence of fixations is important since these are a hallmark of attention-based processes, and thus suggest a '1/f generating-mechanism' is involved in top-down cognitive processes. One significant and perhaps counterintuitive implication is that self-organizing processes may be essential to goal-driven behavior.



A visual scanning path

Timing is Everything - Statistics and Dynamics of Predictive and Reflexive Eye Movements

Mark Shelhamer, Ph.D. received his doctoral degree in Biomedical Engineering from MIT in 1990. While there, he studied sensorimotor physiology and modeling. His research work involved the study of astronaut adaptation to space flight, including participation in two sets of Spacelab experiments carried out on the space shuttle. He then moved to Johns Hopkins where he continued the study of sensorimotor adaptation with an emphasis on the vestibular and oculomotor systems. This has included the opportunity to study adaptation to altered gravity environments (see accompany picture!) through flights in NASA's "vomit comet" parabolic-flight aircraft. In parallel with this, He has applied nonlinear dynamical analysis to the control of eye movements, emphasizing the temporal dynamics of reflexive, reactive, and predictive control. He is the author of *Nonlinear Dynamics in Physiology: A State-Space Approach*, has published over 50 scientific papers, and has had research support from NIH, NSF, NASA, NSBRI, and the Whitaker Foundation.

Presentation Abstract

Ever since the pioneering work of David Robinson in the 1960s, rigorous mathematical approaches have been applied to the study of eye movements. These investigations, originally conducted by those with training in electrical engineering, continue to draw investigators from diverse fields, including physiology, psychology, neuroscience, and engineering. The work that I will describe brings to bear on oculomotor control another in a long and – mostly – successful line of mathematical approaches. After a brief review of the modern history of eye-movement research, I will move on to present my own more recent work on dynamical systems approaches to two types of eye movements: optokinetic nystagmus (OKN) and saccades.

OKN is a (mostly) reflexive eye movement that is driven by a large and homogeneous moving visual field. The resulting eye movements attempt to track the visual field in one direction with slow phases, and snap back occasionally with fast phases to foveate and track a new point. Some aspects of fast phases appear completely random while others have a correlated-noise structure. These correlations imply memory across fast phases, and I will discuss how this statistical structure can change when OKN is stimulated in different manners, which invoke different levels of reflexive and volitional control.

Saccades are rapid re-orienting eye movements that change the line of sight. Human subjects naturally generate predictive saccades when tracking periodically paced visual targets at a frequency above about 0.5 Hz, while tracking at lower frequencies produces reactive saccades. When target pacing monotonically increases or decreases, there is an abrupt transition between the two tracking modes (a phase transition), indicative of a bistable system. Several lines of evidence show that predictive saccade sequences are generated by an internal neural clock.

Reactive saccade latencies are uncorrelated and resemble white noise. Predictive saccade latencies are correlated, so that the performance of previous saccades is taken into account in the timing of subsequent saccades. These correlations are strongest over about two seconds; prediction is enabled when a sufficient number of previous saccades fall into this two-second window, so that their timing error can be monitored. This explains the transition between reactive and predictive tracking: only when target pacing is at a high enough frequency will a sufficient number of previous saccades fall into this window and allow an estimate of inter-stimulus intervals to be made.

Correlations between predictive saccades decay gradually, suggesting fractional Brownian motion (fBm), which is a hallmark of self-organizing systems and demonstrates variations on multiple time scales: trial-to-trial variations correct timing errors while slower variations reflect changing confidence in stimulus history. The longer a fixed stimulus continues, the more confidence there is in programming future behavior based on past performance. This is seen in the fact that correlations between predictive saccades increase as the pacing stimulus continues. (This also leads to hysteresis in the phase transition between reactive and predictive tracking.) I will discuss implications of these long-term correlations, and alternative explanations for their occurrence.

Another example of self-organization is the tradeoff between reliance on previous saccade performance and the current stimulus, and this weighting changes as stimulus variability increases. Thus, saccade sequences exhibit not only predictive behavior, but also the ability to modify predictive properties based on experience, another hallmark of self-organizing systems.

Key Conference "What to Knows"

Registration

Early **Registration fees** for the conference will be US $220 for regular members, $170 for student members and $295 for non-members until July 13, 2008. After July 13, the on-site registration rates of $245/195/320 will apply. The banquet dinner on Saturday August 9, 2008 and refreshments during the conference are included with your registration. Non-members will automatically receive membership and related publications with their registrations.

Hotel

Official lodging for the 18th Annual SCTPLS conference has been arranged through the historic Jefferson Hotel, located within walking distance from the VCU campus. Lodging reservations will be booked directly through the The Jefferson Hotel. A special room rate of $180/night has been arranged for the conference. Visit the conference website for additional information about lodging.

Airport & Ground Transportation

Virginia Commonwealth University (VCU) is conveniently accessed by the **Richmond International Airport.** Transportation from the airport may be arranged by taxi, shuttle or rental car. Taxi average fare is $20.00 per trip. Limousine service can be obtained by contacting the hotel concierge at (804) 649-4615, the charge will be applied to your room. **Local transportation** – the Jefferson offers complimentary transportation to all downtown destinations including the capital Carytown shopping district and the Shacker Skip/Shockoe Bottom entertainment districts.

Publication Opportunity

All presenting conferees are further invited to prepare their papers for review and possible publication in the Society's research journal Nonlinear Dynamics, Psychology, and Life Sciences. NDPLS is peer-reviewed and abstracted in *PsycInfo (Psychological Abstracts), Medline (Index Medicus), and JEL/Econlit.* NDPLS uses American Psychological Association (APA) style. Click JOURNAL on the SCTPLS web site to access Instructions for Authors. **All SCTPLS members receive NDPLS and the SCTPLS Newsletter as a benefit of membership.**

The abstracts to the 18th Annual SCTPLS Conference will be indexed in the *PsycEXTRA* data base after the conference.

Critical Dates for the 2008 Conference

April 9 (Wednesday). Early response for abstracts received by this date.
April 29 (Tuesday). Call for abstracts closes.
May 12 (Monday). All acceptances finalized by Program Chair.
June 1 (Friday). Students who have a paper accepted for presentation must be active members by this date in order to qualify for a Scholarship fee waiver. Qualifying students should contact Dr. Ivelisse Lazzarini, Program Chair drLazzarini@mac.com if they are interested in this opportunity.
June 8 (Sunday). Preliminary program of speakers and abstracts will be available on the web site.
June 8 (Friday). Hotel deadline: SCTPLS cannot guarantee lodging at the conference discount rates after this date.
July 2 (Wednesday). Cancellations of conference registration and lodging will be subject to a 25% service charge starting on this date. July 1 (Sunday). All speakers must register to remain in the program.
July 13 (Sunday). Last day for early-bird registration rate. Speakers must register by this date to remain on the program. *Speakers should note hotel date above, however.*
July 20 (Sunday). Final program will be posted on the web site.
July 21 (Monday). Cancellations of conference registration and lodging will be subject to a 50% service charge starting on this date.
July 28 (Monday). Cancellations of conference registration and lodging will be subject to a 75% service charge starting on this date.
August 4 (Monday). We regret that we cannot offer any refunds for canceled registrations or lodging received after this date.
August 7 (Thursday) Arrive if attending morning workshop next day or starting the fun early!
August 8 (Friday) Registration and Workshops; Sunset Session with Guest Speaker.
August 9 (Saturday) Conference Day; Banquet with Guest Speaker.
August 10 (Sunday) Conference Day; Annual business meeting.

2008 SCTPLS Conference Call for Papers & Symposia
Richmond, Virginia ▪ August 8-10, 2008

We invite all interested scholars to submit abstracts reporting work involving chaos theory, fractals, nonlinear dynamics, complex systems, and related topics. Along with work in all areas of psychology, general biology, neuroscience, medicine, and the social sciences, recent conferences have also included presentations in anthropology, art, education, literature, mathematics, philosophy, and physics. The program will include symposia, panel discussions, a poster session, and sessions of individual papers. Advances in basic or applied research, developments in theory, reports of empirical results, and methodological papers are all welcome. Another format popular with conference attendees in recent years has been short workshops focused on sharing a particular set of techniques or methods, which might include a demonstration of relevant software (short workshops will be scheduled as part of the regular program).

The conference registration fee will be waived for *student members* of SCTPLS who have an abstract accepted.

Instructions for Abstracts

For all abstracts: The connection to nonlinear dynamics, chaos, complexity, fractals or related concepts should be clear to the reader. Please stress what is the *overall value added to the field* (e.g. new method, new information, new perspective or issue, valuable confirmation of the present knowledge, adds clarity to present understanding). The official language of the conference is English.

Length: Abstracts should be between 150-250 words for ***posters, papers***, or ***short workshops***. Abstracts may be up to 500 words for symposia or panel discussions.

Number of submissions: Each person submitting is limited to a maximum of two presentations as first author (it is acceptable to be a co-author on additional submissions by others).

For ***symposia,*** abstracts should reflect the content of EACH speaker's contribution. The format for a symposium is for all speakers to give presentations, followed by or interspersed with discussion. The format for a panel discussion is an introduction to the topic and the speakers, after which the panelists address a series of questions or issues (rather than giving a series of presentations).

For ***panel discussions,*** abstracts should provide a brief overview of the topic, and indicate the relevant back-ground of the panelists and sample questions they will address. The format for a panel discussion is an introduction to the topic and the speakers, after which

the panelists address as series of questions or issues (rather than just giving a series of presentations).

For **experimental work:** background, aims and framework, methods and samples, results, conclusions and Implications should be clear to the reader.

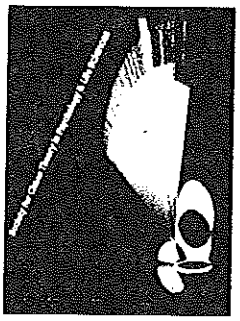
For **theoretical work:** background, aims and framework, mode of inquiry, outcomes, conclusions and implications should be clear to the reader.

Abstract for **workshops** should present state-of-the-art information on techniques useful for conducting research or applications of nonlinear science in the behavioral, social and life sciences. They should be pedagogical in nature, and where applicable emphasize skills that attendees can expect to acquire.

Deadlines: April 9 is early response date for abstracts received by this date. Regular submissions deadline is April 29. Our web portal awaits yours! www.societyforchaostheory.org/conf/2008/cfp.html

Questions? Please contact Conference Chair Ivelisse Lazzarini drLazzarini@mac.com,

▪



Time to Enjoy Our Annual Poster... 2008's is here!

This year, the annual poster is available electronically! Please do not be satisfied with this sneak preview when the real deal is downloadable (583KB) for your on-location printing from www.societyforchaostheory.org/conf/2008/conf2008Poster.pdf

▪

Members' News

Mike Radin reports that he organized a Session on difference equations and applications at the AMS Northeast Regional Meeting in New York City; March 15-16, 2008. He published a paper on *Rats Instigated Dynamics of Easter Island* with Bernard Brooks, Bill Basener and Tamas Wiandt from Rochester Institute of Technology in the *Journal of Nonlinear Dynamics.* The fortunate, hard-working man will be going on his Sabbatical to the Aegean University in Greece in the spring 2009 semester.

▪

Hector Sabelli's hard work, since that reported in the January issue of this Newsletter, has been recovering from the sudden onset of a medical condition. His wife, Linnea, has generously shared the unfolding story of his recovery in reports to family and friends. Fred Abraham has generously shared many of those updates on listserves that reach people who know Hector. Checking in on the ChaosPysch list is a way to stay abreast of Hector's progress.

▪

Kevin Dooley was featured by *Slate* after the US President's State of the Union address in January (http://www.slate.com/id/2183005/): he "ran each of Bush's State of the Union addresses (counting the first one, which was technically an address to the joint Congress) through his algorithms for *Slate*." Kevin used his famous Crawdad Technologies,

Ongoing Calls for SCTPLS Newsletter Submissions

The Society's Newsletter has standing calls for submissions of various kinds. It has been a while since it published articles. This issue begins to get back in the business, so to speak, with a paper on some innovative work (see p. 11). Except for the July issue that double-serves as the annual conference program, it can generally offer space to a concise article in the range of 2,000-3,000 words.

In addition to articles and our standing call for news of books to go on the *Nonlinear Dynamical Bookshelf,* there are two other newsletter features that welcome quite diverse submissions. One feature is the *Re-View Corner,* named to indicate an earnest interest to receive the benefit of members' views, reflections, applications of nonlinear dynamics in practice, and critiques of works published in the field. For example, in this issue, it includes is a substantively reflective report from a participant at this winter's Snowflake ChaoConference, a small annual meeting. This feature also seeks news of articles of interest. None of us can really manage to stay on top of all the interdisciplinary literature that informs our work. Collegially sharing news of noteworthy articles is a supportive service we can perform for one another. When such news is accompanied by one's own take on the paper, as Robert Gregson so often models for us, it helps us pinpoint which papers may deserve our precious time more than others.

The newest feature, which began in January 2008, is called *Little Known Facts and Circumstances of the Society's Roots.* It is a sp(l)ace to co-create our organizational memory by becoming (more) aware of our Society's – and the field's - history and making history at

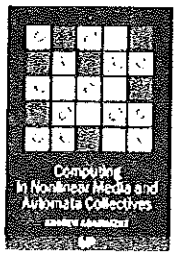
the same time. This feature is for diverse forms of recollections. For example, to tell members about the past emergences of which you are aware: research and interest groups, partnerships, new departments, all the dynamics that fed and still feed this Society's constellation. Recollections galore are especially invited from pioneers in the Society! One of those pioneers, Fred Abraham, has agreed to collaborate with your editor to develop this feature. This is especially helpful since her membership in the Society is only a handful of years old. Snippets of memory, anecdotes, and other forms of reports that trace our roots are welcome. They may range from a few lines, to a few paragraphs, to a few pages, and even a few installments (!).

Newsletter Publication months are October, January, April, and July. Submissions of all of these kinds are welcome year-round. - *Editor*

The Nonlinear Dynamical Bookshelf

We gratefully share book news you send to us. When you find a new or even not-so-new nonlinear book you think we ought to know about, please email the full citation with description, using "Nonlinear Bookshelf" in subject line, to register@societyforchaostheory.org.

Adamatzky, A. (2001). Computing in Nonlinear Media and Automata Collectives. Computing in Nonlinear Media and Automata Collectives presents an account of new ways to design massively parallel computing devices in advanced mathematical models, such as cellular automata and lattice swarms, from unconventional materials, including chemical solutions, bio-polymers, and excitable media. ISBN: 9780750307512.



Carroll, R. J., Ruppert, D., Stefanski, L. A., & Crainiceanu, C. M. (2006). Measurement Error in Nonlinear Models: A Modern Perspective (2nd Ed.). Monographs on Statistics and Applied Probability, Vol. 105. ISBN: 9781584886334. Presents a complete and up-to-date survey of the modern measurement error modeling literature, written by leaders in the field. Provides several case studies and abundant examples along with an index of this material for easy reference. Offers an extensive set of measurement data available for download from the book's Web site. Discusses the use of R, Stata®, and WinBUGS® and supplies downloadable computer code.

It's been over a decade since the first edition of Measurement Error in Nonlinear Models splashed onto the scene, and research in the field has certainly not cooled in the interim. In fact, quite the opposite has occurred. As a result, Measurement Error in Nonlinear Models: A Modern Perspective, Second Edition has been revamped and extensively updated to offer the most comprehensive and up-to-date survey of measurement error models currently available.

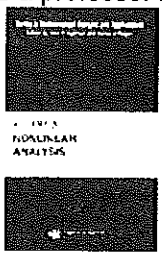
What's new in the Second Edition?

Greatly expanded discussion and applications of Bayesian computation via Markov Chain Monte Carlo techniques

· A new chapter on longitudinal data and mixed models
· A thoroughly revised chapter on nonparametric regression and density estimation
· A totally new chapter on semiparametric regression
· Survival analysis expanded into its own separate chapter
· Completely rewritten chapter on score functions
· Many more examples and illustrative graphs
· Unique data sets compiled and made available online

The authors expanded the background material in Appendix A and integrated the technical material from chapter appendices into a new Appendix B for convenient navigation. This is the most extensive discussion and review of measurement error models. – *Publisher.*

Gasinski, L. & Papageorgiou, N. S. (2005). Nonlinear Analysis. Mathematical Analysis and Applications. Vol. 9. ISBN: 9781584884842. Provides comprehensive, well organized, and self-contained access to important recent developments related to nonlinear boundary value problems. Presents the mathematical foundations of many applied areas, including evolution equations, optimization, optimal control, and mechanics. Covers recent results on critical point theory, nonlinear differential operators, and related regularity and comparison principles. Includes a detailed study of metric and topological fixed points, fixed points based on the order structure of the spaces, and fixed points for set-valued maps Leszek Gasinski is based at the Institute of Computer Science, Jagellonian University, Krakow, Poland. Nikolaos Papgeorgious is a professor in the Department of Mathematics, National Technical University, Athens, Greece.



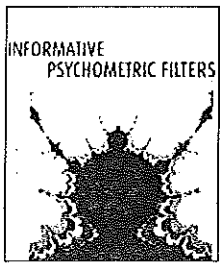
This volume focuses on topics in nonlinear analysis pertinent to the theory of boundary value problems and their application in areas such as control theory and the calculus of variations. It complements the many other books on nonlinear analysis by addressing topics previously

discussed fully only in scattered research papers. These include recent results on critical point theory, nonlinear differential operators, and related regularity and comparison principles.

The rich variety of topics, both theoretical and applied, make *Nonlinear Analysis* useful to anyone, whether graduate student or researcher, working in analysis or its applications in optimal control, theoretical mechanics, or dynamical systems. An appendix contains all of the background material needed, and a detailed bibliography forms a guide for further study.- *Publisher*

Gregson, R. A. M. (2006). Informative Psychometric Filters. Canberra: ANU E Press. ISBN 1 920942 65 3 (Print version), ISBN 1 920942 66 1 (Online). This book is available as a free, downloadable pdf file from http://epress.anu.edu.au/ipf_citation.html .

This book is a series of case studies with a common theme. Some refer closely to previous work by the author, but contrast with how they have been treated before, and some are new. Comparisons are drawn using various sorts of psychological and psychophysiological data that characteristically are particularly nonlinear, non-stationary, far from equilibrium and even chaotic, exhibiting abrupt transitions that are both reversible and irreversible, and failing to meet metric properties. A core idea is that both the human organism and the data analysis procedures used are filters, that may variously preserve, transform, distort or even destroy information of significance. Following the introductory chapter, major sections of the book are 2. Information, Entropy and Transmission, 3. Transients onto Attractors, 4. Inter- and Intra-level Dynamics of Models, 5. A Bivariate Entropic Analogue of the Schwarzian Derivative, 6. Tribonacci and Long Memory, 7. Rescorla's Theory of Conditioning, 8. Nonlinearity, Nonstationarity and Concatenation, 9. Time Series of Disasters, 10. Perron-Frobenius at the Edge of Chaos, 11. Appendix: Nonlinear Psychophysical Dynamics. - *Publisher*



Re-View Corner

The *Re-View Corner* feature welcomes and houses diverse kinds of reviews and alerts to noteworthy work. This space represents a standing invitation to pull up a chair alongside that reserved for Robert A. M. Gregson (ramgdd@bigpond.com), and take time to share what you are reading, learning from, reacting to, experiencing, and critically reflecting on.

Article Alerts

In trying to identify nonlinear dynamics, it becomes necessary to employ a diversity of methods that do not initially strongly presuppose linearity. To start with ANOVA or simple linear regression is in effect to filter out precisely those features that reveal how and where the nonlinearity may feature, either locally or globally. If we are looking at the evolution of processes over time, then falsely assuming homogeneity in a large group, or stationarity in serial dependencies, will blur and mask what is potentially interesting and even diagnostic. A nice example of using a diversity of methodological approaches within one study has just been published. It should interest those of us who do refer separately to Bayesian methods, MCMC, NN, and economics. As the third author, Georg Dorffner, is at the Austrian Research Institute for Artificial Intelligence and Department of Medical Cybernetics and Artificial Intelligence, Medical University of Vienna, (georg.dorffner@meduniwien.ac.at) we can take it that the following paper is of interdisciplinary interest. RAMG

Neural Network Models of Conditional Distribution Under Bayesian Analysis, by Miazhynskia, T., Früwirth-Schnatter, S. & Dorffner, G.
Neural Computation, (208), 20, 504-522.
The e-mail address for the first author is tmiazhyn@pop.tuwien.ac.at.

Abstract: We use neural networks (NN) as a tool for a nonlinear autoregression to predict the second moment of the conditional density of return series. The NN models are compared to the popular GARCH(1,1) model. We estimate the models in a Bayesian framework using Markov Chain Monte Carlo posterior simulations. The interlinked aspects of the proposed Bayesian methodology are identification of NN hidden units and treatment of NN complexity based on model evidence. The empirical study includes the application of the designed strategy to market data, where we found a strong support for a nonlinear multilayer perceptron model with two hidden units.

▪

Following some recent discussion on the CHAOPSYCH list about the identifiability of nonlinear dynamics with continuous and with discrete data sets, a new tutorial paper on related matters is of interest and I think some will find it helpful. I have no e-mail for the author, but he is at Dept. of Math Sciences, Univ of Wisconsin-Milwaukee, Milwaukee WI 53201-0413, USA. RAMG

Tsonis, A. A. (2007). Reconstructing dynamics from observables: The issue of the delay parameter revisited. International Journal of Bifurcation and Chaos, 17, 4229-4243. Key words: attractor reconstruction, nonlinear dynamics, chaos, dimension estimates. The effect of delay is investigated thoroughly, using as an example the Lorenz (1963) attractor, and a definite answer to dimensional estimation is offered as well as a procedure to reconstruct attractors.

Book Alert

Powell, W.B. (2007). Approximate dynamic programming. John Wiley & Sons. ISBN: 9780470171554 *[Newsletter editor's note: If you have this, or get it, please consider submitting a review of it here.]* Subject(s): Probability & Mathematical Statistics, Computer Programming. Provides an introduction to approximate dynamic programming. This book places emphasis on how to model complex problems and design practical, scalable algorithms for solving them. Section Contents: 1. The challenges of dynamic programming. 2. Some illustrative models. 3. Introduction to Markov decision processes. 4. Introduction to approximate dynamic programming. 5. Modeling dynamic programs. 6. Stochastic approximation methods. 7. Approximating value functions. 8. ADP for finite horizon problems. 9. Infinite horizon problems. 10. Exploration vs. exploitation. 11. Value function approximations for special functions. 12. Dynamic resource allocation. 13. Implementation challenges. The final part, 13.7, admonishes the reader: If it works, patent it!

Reflective Report

The Snowflake 2008 ChaoConference Wesleyan University, Middletown, Connecticut, USA, February 22-24
A Personal Commentary by Fred Abraham, Part I

Here I will take the position that our Snowflake Community is united by a common place, a *topoi*, of philosophy, social and metaphysical. I will not try to cover all the presentations. They can be found on our web sites.[1]

Just before the conference I sent a memo that said I saw three themes evident in the presentations to be made at the conference, namely, (1) Creative Evolution: Stellar, Chemical, Biological, Cultural, Personal, (2) Existentialism: What it means to be human, and (3) A Program of Emancipation (Postmodernism/Critical Theory, Philosophical Hermeneutics, Post-Analytic Philosophy). To introduce my opening paper (2007) I covered hominid evolution from *A. afrenesis* to *H. sapiens*, pointing mainly to the evolution of brain and the plasticity of mind and behavior. Then I shifted to science fiction and artificial intelligence and the potential evolution of humanity as being embodied in cyberspace and cyborgs, which touches on emancipation (especially in differing portrayals of gender issues—Cybersexuality[2]). Hector Sabelli's presentation was to be next as it is involved the idea of creative evolution as exemplified in his BIOS (which we summarized), which deals with the evolution of dynamic systems into the more complex regimes beyond the usual portrayals of chaos. At this point, because of Hector's drastic condition, Carlos Torre, his close friend, told something of Hector and his humanity. (Hector has since staged a remarkable recovery from a catastrophic collapse.)

Since my story, and Hector's, especially in his play *Maria/Mary* from which Carlos read, involved existential issues, it seemed natural to segue to Mallary Tytel's presentation of Sartre's *Existentialism as a Humanism.* After stating her belief in Wolfram's assertion of the importance of simple rules, she captured the essential ideas of Sartre within a dynamical framework. She started with a quote: "Man is nothing but what he makes of himself." Then she went to her simple rules for the relationship between existence and essence, the later coming from the act of free self-creation of the former, and five rules of how that is accomplished: no predetermined essence controlling us, freedom from outside influences, we create our own human nature, our values through these free choices, we are thrown into existence and later construct our nature (essence) through our actions. Essence is activism, which leads to choice, which leads to subjectivity, which leads to choice, which leads to responsibility. This includes seeking purpose outside of ourselves. There is the responsibility of choosing our own nature and values, which is greater because external forces cannot take it from us (the dynamics of self-organization, or autopoetics). She pointed out that an external perspective is always involved, and wrote on the easel-pad: CONTEXT MATTERS. This immediately became a theme of the conference, as it entered into programs and philosophies of virtually all the topics within the conference.

I wish to invoke philosophical hermeneutics as a potential meta-perspective with which to view our conference and the Snowflake community. It is not a necessary one, but, for me, it is a compelling one. I view it as symbiotic with our systems-theoretic point of view, but perhaps even taking priority within this symbiosis. Karen vander Ven (2004) states this idea best: "In a postmodern context this paper proposes that analogical scholarship in which one conceptual schema is used to view another in order to generate new perspectives, be used to view play. Hermeneutic philosophy specifically is used in a process modelling hermeneutic inquiry."

Karen points out that an "interpretivist method of inquiry" means listening to play, and a "focus of inquiry is the relationship between play (as one aspect or construction of human behavior) and hermeneutics...." This emphasis on the interplay, the inseparability of interpretation and creation, is also reflected by Crusius (1991) within his discipline of composition, when he speaks of the interplay between hermeneutics and rhetoric. So there is an interplay between interpretation and the creativity of rhetoric, that is speech and composition, Crusius' subject, just as play in education is Karen's and Doris Fromberg's arena of inquiry. For Enrico Wensing, there is an interplay between the

[1] http://www.blueberry-brain.org/winterchaos/Winter_Chaos_2008.htm

[2] http://impleximundi.com/tiki-index.php

individual, the community, and the biosphere, a very complex interplay, and all aspects of this interplay must be brought into awareness (interpretation), and a viewpoint, if not of philosophical hermeneutics of something akin to it, provides a coherent perspective on this process that also provides some prescription for action (a là Karen's assertion supra). This phenomenological existentialism is embodied in the title of the approach his global project takes, "I am Sustainability." The acts of creation involve the acts of interpretation; their entwining is the attractor of personal, communal, and environmental progress.

Besides the ideas of the interplay between interpretation and creation, and the essential role of responsibility of self-realization, another basic idea of hermeneutics is that of looking at the search for knowledge as not that of establishing essential eternal truth, but that of seeking a process of continual discovery of new ideas, contrary to a long history of philosophical inquiry (an idea also mentioned by Poincaré, and also at the foundation of the Heraclitus-Parmenides difference). Bob Porter expressed this distinction well. While he focused on the moral insights of Martha Nussbaum, he notes that

> we idealistic scientists have been drawn to the hopeful blend of formalism and freedom that chaos provides. . . Now an interesting thing about this post-modern concept of the arbitrary relation among things is that it parallels that which we nonlinear folks see in the relation between points on the trajectory of a chaotic attractor. That is, the relation between any two points is arbitrary because there is no sure way to designate a privileged pair. Thus the emphasis in post-modernism, as in chaos theory, is on the arbitrary, unpredictable inter-connectedness of things...In terms of politics and social policy, Nussbaum's focus is on not on the rule of law but, rather, on the role of law in encouraging and guiding beneficial political, social, and policy changes. That is, Nussbaum's approach is not as much one of ethical and moral proscription as it is a prescription for the creation of socio-political environments that foster the goals of life, liberty, and the pursuit of happiness.

I point out that law and ethics are hermeneutic enterprises, and that the Porter-Nussbaum view is a process view, not a logocentric one (as the post-moderns, would say), and thus another instantiation of philosophical hermeneutics. Time and space and the Newsletter deadline, do not permit showing how the other participants' presentations, very diverse (from air line accidents due to miscommunication, Steve Cushing, again hermeneutics, to positive psychology now supported by research using dynamical systems theory, Frank Mosca) in their own disciplinary and philosophical perspective of their own, fit into this thesis I present here. I can only take the time to say that this is the most exciting conference we have ever had. It was electric with all participating in all presentations, and constantly cross-referencing each others' ideas (possible only in such a small conference of about 20 people in plenary sessions. Meanwhile, individual presentations can be found on our website.

In Part II, I will try to present more about the work of Bob Eldridge, economist, Tina Champagne, Rehabilitation Therapy, David Gibson, cyber education, Martin Gardiner, music education/research, Carlos Torre, innovational educational projects, Doris Fromberg's use of play in early education, Roulette Smith's approach to aberrations of Common Sense, Jerry Chandler's unique development of a logico-mathematical theory of chemistry, and Mark Filippi and George Muh's unique and intriguing approaches to the dynamics of chiropractics. We will also try to include Linda Dennard's post-modern theories of administration, freedom, and creativity, although she was prevented from getting to the conference because of messed up airline connections.

References

Abraham, F.D. (2007). Cyborgs, Cyberspace, Cybersexuality: The Evolution of Everyday Creativity. In R. Richards (Ed.), *Everyday Creativity and New Views of Human Nature: Psychological, Social, and Spiritual Perspectives*. Washington, DC: American Psychological Association.

Crusius, T.W. (1991). *A Teacher's Introduction to Philosophical Hermeneutics*. Urbana: National Council of Teachers of English.

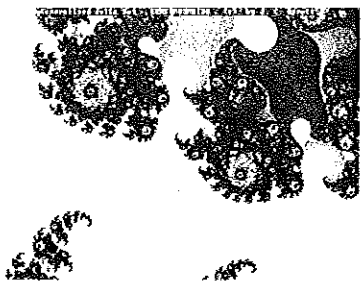
Nussbaum, M.C. *Sex & Social Justice*. New York: Oxford University Press, 1999.

Sabelli, H. (2005). *BIOS: A Study of Creation*. Singapore: World Scientific.

Sabelli, H. (2002). *María / Mary* Bilingual play (Español-English) with historical notes, by H. Sabelli. Preface by K. Northcott Ph.D. Foreword by C. Torre, Ph.D. Chicago, IL: SACP.

Sartre, J-P. (1946/1973). *L'Existentialisme est un humanisme* (*Existentialism is a Humanism, http://en.wikipedia.org/wiki/Existentialism_is_a_Humanism*). Transl. Philip Mairet. London: Methuen.

VanderVen, K. (2004). Beyond Fun and Games Towards a Meaningful Theory of Play: Can a Hermeneutic perspective Contribute? Social Contexts of Early Educaton, and Reconceptualizating Play (II), Advances in early Education and Day Care, 13, 165-205. Elsevier.



Non-Euclidity of Living Systems, Systems Specific Relationships and Self-Scaled Relationships of Relationships: The Evidence Beyond Obvious and Measurable[3]

Vadim Kvitash,[4] G.A. Swanson,[5] and Boris Gorbis[6]

Abstract

This paper represents the most recent development in both Theoretical and Applied Systems Intelligence by exploring the discovery of the following fundamental novelties: (1) Two types of Non-Euclidity of Living Systems, (2) Basic Units of Relationships of Relationships, (3) Six Autonomic Natural Laws operating in Living Systems on a systems level, (4) Introduction and delivery of operational package containing *23 novel primary systems level measures* which can be exploited for effective assessment of systemity, systems level processes, and super complexity of Living Systems functioning, as well as functioning of other types of Super Complex Systems of any nature, (5) Introduction of irreducible 2D and 3D basic and higher level units of systemity, (6) Irreducible minimal and complete model of systemity, (7) Demonstration of direct application of one of these measures in the case study of a patient with metastatic cancer.

Introduction

In inventing measures of "... relationships of relationships and interactions of interactions... lies the most challenging quest of systems science – the understanding of life." [Swanson, 2005]. While the representation of the process of forming relations of relations so far has proven illusive, the representation of a process of the orderly decomposition of such systemity is proving less forbidding. *Relonics* is a new exact science with its own Systems Intelligence Platform that can provide effective tools to explore previously unknown, completely hidden beyond quantitative information, deep dimensions of Living and other Super-Complex Systems. *Relon,* is an irreducible basic unit of self-scaled systems-specific relationships, which exists *between* any two measurable elements of the given systems. Relons can be simultaneously assessed in a *quantitative-qualitative–relational-directional way,* and then can be visualized as patterns of systems level networks (Kvitash, 2002). Any relons and their networks represent pattern(s) within a complex structure. Depending on a specific task, relons as well as any other empirical or theoretical entities, can be seen and contextualized as a *thing*, or as a *property*, or as a *relationship* (Uyemov, 1965, 2003).

Triangle as a Minimal Model of Systemity

Triangles as the simplest geometric figure always assume new forms, shapes and configurations in response to any changes of their sides, or their angles. Triangles always possess two indispensable and basic features, which define systems: (a) they have elements (in this case 3 nodes), and (b) they have a complete set of relationships between all of those three elements. Therefore, basic properties of triangles completely fit any existing definitions of the systems because they are actually representing elements in standing relationships. It can easily be seen that a triangle, which is a minimal geometric figure, possesses all defining properties of the systems, and always exhibits systems-specific behavior, meaning that any changes in its angles, or any changes in each of its sides, or each of its nodes, immediately and invariably produce changes in all other properties of triangles. Considering those essentially systemic properties of triangles, they can be seen as a *minimal and complete 2D geometric model of systemity.* Four triangles can form a tetrahedron, which can be seen as a *minimal* and *complete 3D geometric model of systemity.*

Basic Units of Systemity: Trilons and Tetralons

A triangle formed by three relons is called *Relonic Triangle* or *Trilon.* Four trilons can form *Relonic Tetrahedron* or *Tetralon.* As any other triangles and tetrahedrons, trilons as well as tetralons invariably respond to changes in the length of any of its sides as a system. Those *2D* and *3D* basic units of systemity always exhibit characteristic systems-specific behavior, where any changes in one element can affect the entire system, and therefore should be rightly accepted as basic units of systemity and complexity.

Non-Euclidity of Trilons and its Measures

Three elements from any system of interest can be easily singled out conceptually, and presented as trilons. That process of singling out does not in any way affect or destroy the system itself. Trilons measured out in Self-Scaled Natural Systems-Specific Units (Kvitash, 2002), can assume infinitely different sizes and configurations. In Euclidian geometry, the sum of any two sides of a triangle is always greater than the remaining side. Such a figure is a perfectly Euclidian one. Triangles that do not satisfy that condition do not belong to Euclidian geometry, and in such cases we are faced with the paradox, which was resolved by introducing non-Euclidity of Living Systems (Kvitash & Gorbis, 2006). There are two kinds of non-Euclidity in Living and Super Complex Systems: (1) *Relonic non-Euclidity* [RnE], and (2) Minimal *Relonic non-Euclidity* [mRnE]. While Euclidian triangles [E] have no side larger than the sum of the other two, the [RnE] always has such a side. In the case of [mRnE], one of the sides is neither smaller nor larger, but equal to the sum of the other two sides. Therefore, each trilon can be assessed by three measures of their dimensionality: as [E], or as [RnE], or as [mRnE]. In addition, Relonic non-Euclidity can be measured by the degree of their non-Euclidity [P°], which can run from [1P°] to its computational limit of [3,233P°]. The quantitative and qualitative Dynamic of Transformation from one Dimension to another Dimension can be measured and can be expressed by nine definitive trajectories: [E to RnE], [E to mRn], [RnE to E], [RnE to mRnE], [mRnE to E], [mRnE to mRnE], [E to

---

[3] Paper to be presented at 19th European Meeting on Cybernetics and Systems Research in Vienna, March 25- 27, 2008.

[4] School of Medicine, UCSF Personal Health Response, Inc. kvitash@hotmail.com

[5] Tennessee Technological Univ., GASwanson@tntech.edu

[6] Personal Health Response, Inc. bzgorbis@msn.com

E], [RnE to RnE], [mRnE to mRnE]. At this point, there are now available 13 novel primary operational measures for detection and effective exploration of previously unknown, and deeply hidden fundamental dimensions of Living Systems.

Basic Units of Relationships of Relationships

Between any pair of relons there exists a more complex type of relationship, which is a *relationships of relationships*. A basic unit of such relationships of relationships is termed as *meta-Relon*. The relationships of relationships between relons constitute the level-1 of relationships of relationships [R(R)L1]. The relationship between relationships of relationships of first level can progress to the meta-relons of second level, and so on to infinitely higher levels of meta-relons. It is easy to see that (a) each meta-relon incorporates and reflects the interaction of each prior level, and (b) that while particular systems exists it presupposes the presence of higher meta-relonic level of complexity. In this sense, one could ascribe to any meta-relon level a systemic property of *betweenity*, the property that disappears upon the destruction of the system itself. In the same way as relons, meta-relons also can be considered as a *thing*, or as a *property*, or as a *relation*, or any combination of them (Uyemov, 1965, 2003).

Higher Level Units of Systemity

Just as trilons, any three meta-relons can be singled out and represented as *meta-Relonic Triangles* or *meta-Trilons*. Meta-trilons, in contrast to trilons, can exist only in one dimension. Dimensionality of meta-trilons are always and only the same - [mRnE], in contrast to trilons which can exist in one of their three distinctly different dimensions -- as [E], or as [RnE], or as [mRnE]. Theoretically, *betweenity* of meta-trilons can run to infinity, which is graphically represented in Figure 1 in the form of a stable and highly ordered progression of icons of nested triangles, where infolding of meta-relonic infinite betweenity very elegantly reveals itself. However, there is a computational limit to meta-trilonic level, which cannot exceed [R(R)L98]. This property of meta-trilons is identified as *meta-Trilonic Run* [mTR], which makes that property of meta-relons quantitatively measurable, comparable, analyzable, and particularly useful in working with Living Systems as well as any other types of Super-Complex Systems of diverse natures.

Emergent Properties of Higher Levels Units of Systemity

As we move from relons to meta-relons of first level and then to higher levels, some of their intriguing properties begin to emerge. To make those emergent transformational properties transparent, let us consider the following examples.

Euclidian Meta-Trilonic Matrix

13	6	5	4	3	2	1	1
18	11	6	5	4	3	2	0
7	5	1	1	1	1	1	1

In this 3x8 matrix, the first column consists of the numerical value of each of three initial relons. Columns 2 through 7 represent transformation of numerical value at each consecutive level of relationships of relationships from level 1 to level 6. One can see that this Euclidian trilon of 13, 18, 7 has lost its Euclidity (18 < (13 + 7)) and immediately transformed into a meta-trilon of the first level of relationships of relationships with [mRnE] dimensionality (11= (6+5)). This property of Minimal Relonic non-Euclidity remains unchanged up to the last level [R(R)L6]. Column 8 in this matrix shows that after level 6, one of three sides of the meta-trilon reached its vanishing point, and therefore ceased to exist as a metatrilon, and now its property of meta-trilonic betweenity is no longer present.

Relonic non-Euclidian Meta-Trilonic Matrix

2	4	3	2	1	1
3	5	4	3	2	0
7	1	1	1	1	1

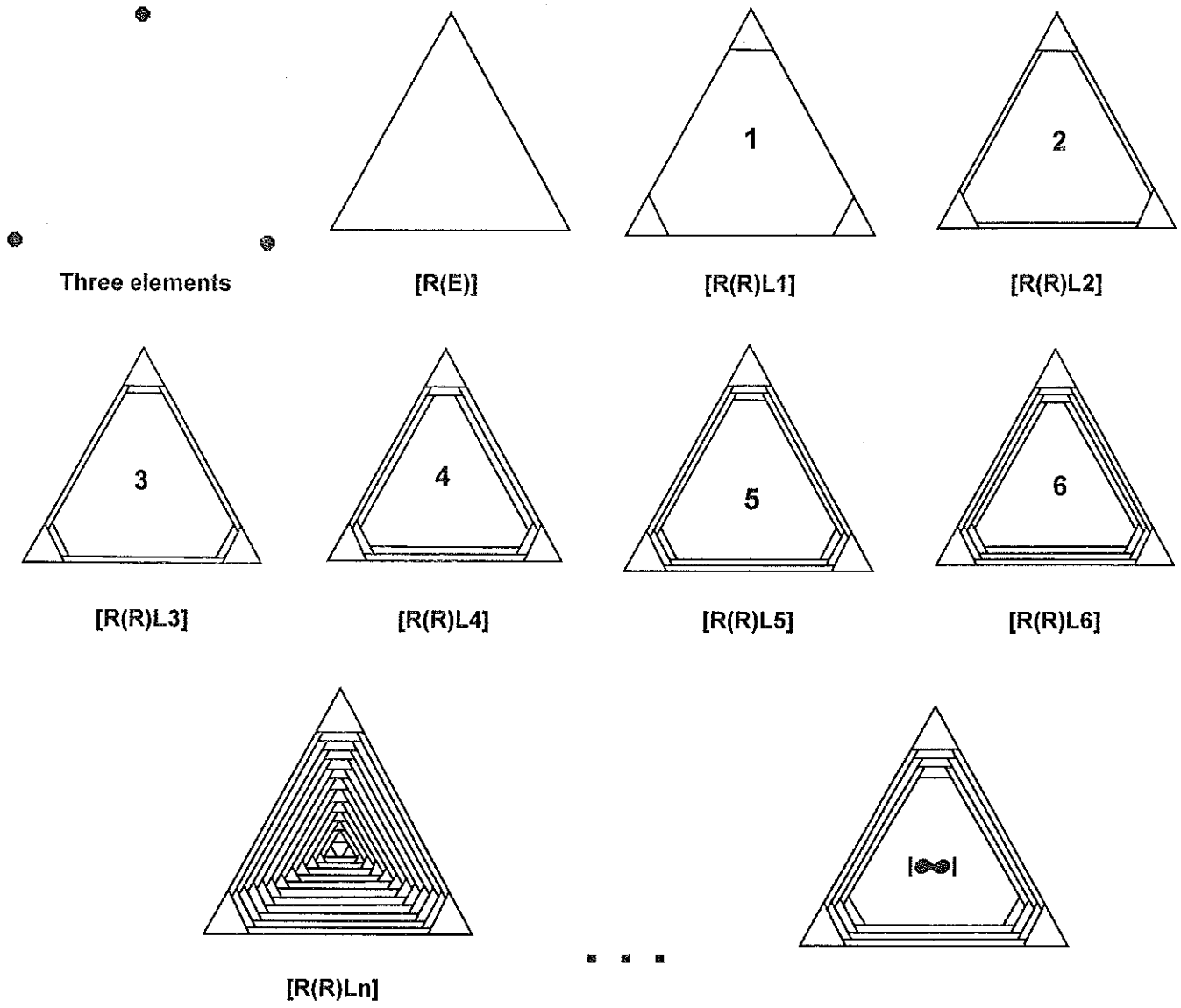
In this 3x6 matrix, the first column is the numerical value of three relons: 2, 3, and 7. Columns 2 through 5 represent deterioration of numerical value at each consecutive level of relationships of relationships from level 1 to level 4. Column 6 shows that in this case, computation of meta-relons of higher than the 4th level of relationships of relationships is no longer possible. Again, this [RnE] trilon of 2, 3, and 7 lost its Relonic non-Euclidity (7 > (2 + 3)) and *likewise transformed* itself into the same [mRnE] dimensionality (5 = (1 + 4)) on the first level of relonic relationships of relationships. As in the previous case, its [mRnE] remained unchanged till the last fourth level [R(R)L4]. After that, metatrilons cannot progress to the next level of relationships of relationships, and its betweenity is no longer present.

Minimal Relonic non-Euclidian Meta-Trilonic Matrix

5	5	1	3	2	1	1
6	1	1	1	1	1	1
11	6	5	4	3	2	0

In this 3x7 matrix, in the now predictable fashion an initial [mRnE] trilon of 5, 6, 11 *did not lose* its *Minimal Relonic non-Euclidity* (11=(5+6)) and *continued to retain Minimal Relonic non-Euclidity* at each subsequent level of relationships of relationships (from level 1 through level 5), and then, like in the previous cases of trilons with different dimensionality, meta-trilon ceased to exist as a triangle.

This pattern of immediate transformation from Euclidity to Minimal Relonic non-Euclidity, as well as immediate transformation from Relonic non-Euclidity to Minimal Relonic non-Euclidity seems rather puzzling and intriguing. At this point, we are faced with "... an interesting mathematical fact" (P. Davis, January 12, 2007, email communication), which should not escape notice. That has to do with something previously unknown - the mathematical fact that a basic arithmetic operation known as subtraction, in special situations acquires the completely new and unexpected property of the *systemic operation*, and therefore can be considered as a *systemic procedure* able to generate unique information of the highly specific systemic nature. That transformation of regular triangle to minimally non-Euclidian triangle by simple subtraction, and the fact that those sequential subtractions in similar manner show that Minimal Relonic non-Euclidity as a property remains unchanged until meta-trilonic triangles are no longer computationally possible. *First*, here for the first time we are facing that Relonic non-Euclidity and Minimal Relonic non-Euclidity, are a novel, fundamental, and important property of supercomplex systems and their dynamics. *Second*, it raises a few profound questions in Philosophy of Mathematics, and in Number Theory. *Third*,



Legend:

[R(E)]	Relons – systems-specific relationships
[R(R)L1]	First-level relationships of relationships
[R(R)L2]	Second-level relationships of relationships
[R(R)L3]	Third-level relationships of relationships
[R(R)L4]	Fourth-level relationships of relationships
[R(R)L5]	Fifth-level relationships of relationships
[R(R)L6]	Sixth-level relationships of relationships
[R(R)Ln]	n-level relationships of relationships
| ∞ |	Meta-Relonic Infinite Betweenity

Figure 1. Infolding of Meta-Relonic Infinite Betweenity

it demonstrates a very unusual and unexpected property of subtraction as a basic arithmetic operation. *Fourth*, it reveals unique property of subtraction, which other arithmetic operations such as addition, division and multiplication, is lacking. All four arithmetic operations change only quantities in different ways, but only one, subtraction, under special conditions, can drastically transform dimensionality. In other words, operation of subtraction in a set of any three positive or negative numbers can produce not only quantitative changes but also qualitative transformation as well.

Systems Level Laws Operating in Living and Other Types of Super-Complex Systems

Generalization of the basic and emergent properties of trilons and meta-trilons leads to formulation of six Autonomic Natural Laws operating on a systems level defining intrinsic properties of trilons and meta-trilons, as well as controlling dimensional transformation of relationships of relationships existing in the Living Systems as well as other types of Super-Complex Systems of any nature.

1. *Law of Trilonic Dimensionality.* At any given moment, trilons can exist only in one of three possible for them dimensions: as Euclidian Trilons, or as Relonic non-Euclidian Trilons, or as Minimal Relonic non-Euclidian Trilons.
2. *Law of Meta-Trilonic Property.* Meta-trilons always exist in only Minimal Relonic non-Euclidity dimension.
3. *Law of Loss of Euclidity.* Immediate and irreversible loss of Euclidity at the first level of metatrilons.
4. *Law of Loss of Relonic non-Euclidity.* Immediate and irreversible loss of Relonic Non-Euclidity at the first level of meta-trilons.
5. *Law of Transformation.* Immediate transformation of Euclidity, as well as Relonic non-Euclidity into Minimal Relonic non-Euclidity at the first level of metatrilons.
6. *Law of Conservation and Preservation.* Metatrilons constantly retain their acquired property of Minimal Relonic non-Euclidity from the first to the last computationally possible level of relationships of relationships.

Case Study: Relationships of Relationships in Assessment of Cancer

It is a well known fact that cancer which is destined to affect one in three persons at some point in their lives is frequently detected only after years of neglect and suffering [Vaughn, 2007]. It is intriguing to see what it would be like to apply *just one* of now available 23 primary measures of systemity in the form of metatrilonic run [mTR], to the real case of that worldwide medical problem.

A paradigmatic example of patient with confirmed definitive diagnosis of *Carcinoma with extensive metastasis to the Liver* coded as Wa-7, is presented below and compared with Normal Reference of [mTR]. For the purpose of demonstration, only one randomly selected trilon #219 (AST–LDH–Total-Bili) was singled out from the set of 220 trilons derived from 12 basic biochemical variables taken as a complex system: *Albumin – Calcium – Phosphorus –AST –Glucose -Alkaline Phosphatase – LDH - Total Bilirubin - BUN - Uric Acid – Cholesterol - Total Protein* and quantitatively expressed in Natural Systems Specific Units. The following two matrixes represent relons #219 and their meta-Trilonic Runs of relationships of relationships in Normal Reference, and in Case Wa-7.

Reference [mTR] of Trilon #219

14	1	1	1	1	1	1	1	1	1	1	1
38	24	23	22	21	20	19	18	17	16	15	14
39	25	24	23	22	21	20	19	18	17	16	15

1	1	1	1	1	1	1	1	1	1	1	1	1	0
13	12	11	10	9	8	7	6	5	4	3	2	1	1
14	13	12	11	10	9	8	7	6	5	4	3	2	1

In this 3x26 Reference matrix (represented in two parts), the first column represents normal trilon #219 which has numerical values of 14, 38 and 39 of Natural System-Specific Units. That reference trilon #219 is perfectly Euclidian. The second column of 1, 24, and 25 represents level-1 of meta-trilon of metabolic relationship of relationships which already lost its perfect Euclidity, immediately transforms into Minimal Relonic non-Euclidity, and continues to run down to [R(R)L24]. After that level, normal reference meta-trilon #219 is no longer calculable, and therefore cannot progress to the next level.

Case Wa-7 [mTR] of Trilon #219

12	22	6	10	6	2	2	2
34	6	16	6	4	4	2	0
40	28	22	16	10	6	4	2

In this 3x8 matrix of Case Wa-7 meta-trilons had progressed *only* to [R(R)L6]. After that level-6 metatrilons cease to exist. That Meta-Trilonic Run of relon #219 of Case Wa-7 was compared and contrasted with Reference meta-Trilonic Run of relon #219. It has become immediately obvious that patient with Metastatic Cancer *has lost 18 levels* of metabolic relationships of relationships and now has *86% shorter* meta-Trilonic Run in relon #219. At this time it is completely unknown what kind of physiological mechanisms are behind such drastic differences from normality in a range of metabolic relationships of relationships in relon #219 of Case Wa-7. It is important to note that each metabolic trilon can be assessed not only by its meta-Trilon Run but also can be classified to what type of Dimensionality this relon is in, as well as by other primary measures of systemity like trajectories of Dimensional Transformation Dynamics.

Also, Case Wa-7 of Metastatic Cancer demonstrates that systemity can be exactly quantitated. The process of losing complexity of relationships of relationships during progression of cancer can be effectively used for more precise disease staging, for treatment monitoring, for assessment of treatment response, and possibly for early diagnosis of cancer. It is also very promising to use all other 22 now operationally available primary measures of systemity as novel systems level tools for better objective assessment of disease activity, severity, for

personalized treatment, and for categorical individual prognosis. Future research in this area may improve accuracy of medical diagnosis and bring a novel and better understanding of deep systems level pathophysiologic processes hiding behind mechanistically known mechanisms of health and disease.

Findings and Significance

The significance of this presentation lies in the advancement of both Theoretical and Applied Systems Intelligence.

Major Systems Theoretic Findings

1. Development of minimal and complete geometric model of systemity.
2. Discovery of Relonic non-Euclidity and Minimal Relonic non-Euclidity as novel fundamental properties of Living and any other Super-Complex Systems.
3. Description of basic units of systems-specific relationships (relons), and systems-specific relationships of relationships (meta-relons).
4. Identification of higher level units of systemity: trilons and tetralons.
5. Formulation of six Systemity Laws operating in Living and other Super-Complex Systems.

Major Applied Systems Findings

1. Any and each of trilons can be assessed by *3measures* of their Dimensionality: as Euclidity [E] Relonic non-Euclidity [RnE], and Minimal Relonic non-Euclidity [mRnE].
2. Relonic non-Euclidity can be quantitatively assessed by *2 measures*: degree of Relonic non-Euclidity [P°] and meta-Trilonic Run [mTR].
3. Euclidity as well as Minimal non-Euclidity can be measured quantitatively only by meta-Trilonic Run [mTR].
4. Dynamic changes in any and each of trilons can be assessed by *9 measures* of trajectory of their Dimensional Transformations.
5. Any and each trajectories of Dimensional Transformation can be assessed by *9 measures* of coupled dynamics of [[P°] + [mTR]].

Conclusion

There are now available *23 novel primary measures* of systems level information and systemity, which are operationally proven, and useful. Each of the 23 measures and any combinations of them can be applied for assessment of trilons of choice taken from real-life systems. Application of those measures creates a new kind of systems level information which is otherwise completely hidden beyond quantitative variables when they are not taken as a complex systems and not measured by Systems Intelligence Tools.

References

Kvitash, V. (2002). Relonics: Balascopy based systems-specific technology. *Kybernetes, 31*(9-10), 1471-1480.

Kvitash, V. & Gorbis, B. (2006). Relonics properties of living systems. *Cybernetics and Systems 2006, Proceedings of the Eighteenth European Meeting on Cybernetics and Systems Research*, Vienna, Austria, Vol. 1, pp. 167-172.

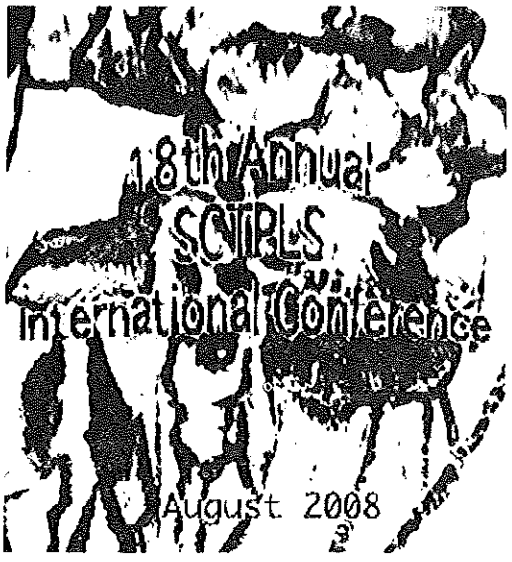
Swanson, G. A. (2005). The study of pathology and living systems theory. *Systems Research and Behavioral Science, 22*(5), 365.

Ujomov, A. (1965). *Dinge, Eigenschaften und Relationen.* Berlin: Akademie Verlag.

Uyemov, A. (2003). The ternary description language as a formalism for the parametric general systems theory: Part III, *International Journal of General Systems, 32*(6), 583-623.

Vaughn, J. (2007). Dad's cancer inspires son's question for answers. *San Francisco Chronicle,* p. M4, February 11, 2007.

Coming up! Don't miss it!

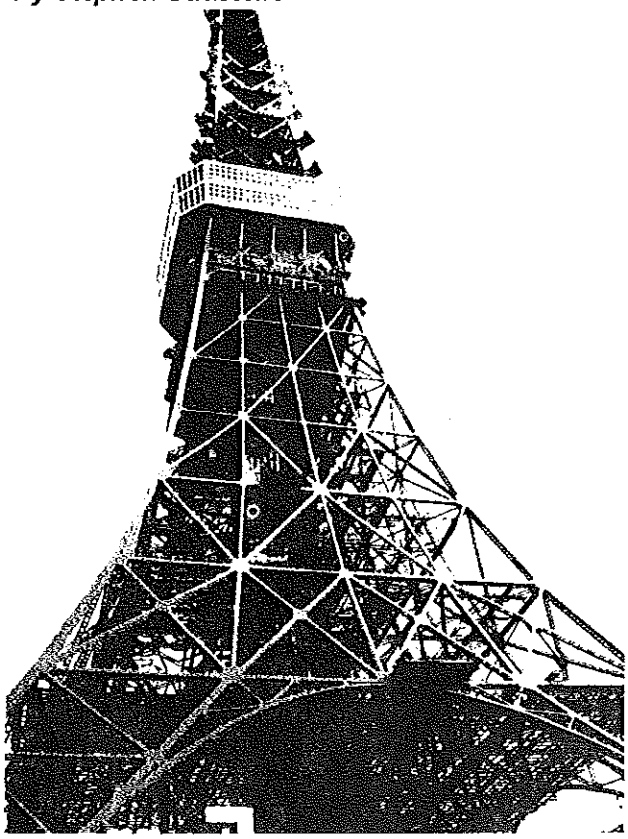


We hope to see  **you in Richmond!**

Subscriptions to *Nonlinear Dynamics, Psychology, and Life Sciences* and the *SCTPLS Newsletter* come with Society Membership!

Some Highlights from the 3rd International Nonlinear Science Conference, Tokyo

By Stephen Guastello



The 3rd International Nonlinear Science Conference was held in Tokyo, Japan, March 13-15 at Chuo University. A total of 85 members participated in the event, which is a strong turnout for this SCTPLS conference series. Special applause go to Yuji Aruka for orchestrating the comfortable and well-equipped facilities for this event, the Japanese Association for Evolutionary Economics for bringing so many agent-based systems researchers to the program, and the Faculty of Commerce of Chuo University for special touches such as the conference bags, arrangements for tea ceremony and the menu for the gala banquet that we all enjoyed on Friday evening of the conference. Another round of applause goes to Ivy Lazzarini and Dimitrios Stamovlasis for all the program logistics, and the numerous members of the scientific review committee.

This report captures some of the substantive contributions to the conference. Inasmuch as there were three tracks going on most of the time, and note-taking being what it is sometimes, the following is only a sampling of what transpired. A full set of abstracts is available on the SCTPLS web site, and the abstracts will be included in the American Psychological Association's *PsycEXTRA* data base for search and retrieval.

Technological change. In neo-classical economics macroeconomic processes are simple extrapolations of individuals' interactions with markets. Real macroeconomic processes work differently as Dore and Rosser (2007) explained to us recently. Masano Aoki, the first plenary speaker of the INSC, modeled the statistical arrival of two macro processes in an economy to represent forms of technological change. Whereas the typical modeling procedure would use mean/variance ratios, or only means, the results are very misleading such that the behaviors of the 100 largest firms in an economy produce a distorted interpretation of the economy as a whole. The actual distribution of new technological entries of different types is a power law distribution instead. The odds of a new technological entry, given an array of technologies that already exists, depends on whether the new entry represents a new technology altogether or attaches itself to an existing cluster. Further analyses indicated that less technologically advanced societies could develop as the same rate as the more advanced societies. Further theory and research can be found in Aoki's new book (Aoki, 2007).

Synchrony in Psychotherapy. In two adjacent presentations Wolfgang Tschacher and Fabian Ramseyer studied the role of synchrony in clinical psychology applications. In the first study patients and therapists completed questionnaires regarding their interpretations of what transpired in the sessions regarding the patient's coping capacity, psychopathology and symptoms, aversive interpersonal behavior, and pro-social interpretations of behavior. Synchrony was captured by Lansfield's Ω index, which is a formal measure of entropy that is widely used in ecology and biology. There was a strong effect for synchronicity on therapy outcomes.

In the second phase of their work, Tschacher and Ramseyer examined the synchronicity of body movement between therapists and clients, noting that the patterns could be different in the early, middle, and later phases of each session. The early phase establishes some stability between the two people as they catch up on events since the last session. The middle portion is devoted to exploring issues in depth, and in the third phase they reconsider and assimilate what has been learned. Digital videotapes of sessions were analyzed for the amount of pixel overlap and transition between the client's and therapist's movement envelopes. Once again, there was a strong association between synchrony and good therapeutic outcomes at the end of a series of sessions. Patients with more social problems, or more security issues, tended to exhibit less synchrony with the therapists. The therapists, meanwhile, tended to be unaware that their movements were synchronizing with their patients'.

Motor learning. Gottfried Mayer, our second plenary speaker, examined learning processes in complex movements, using the front tuck in gymnastics as an example. An important point is that a movement such as a front tuck is never executing exactly the same way twice, even by professional gymnasts, and referees engage a little or a lot of judgment as to whether a

particular example meets the prototype movement. Bistability and hysteresis can be observed in the learning process as shown in Fig 1, which is the frontal slice of a cusp catastrophe model.

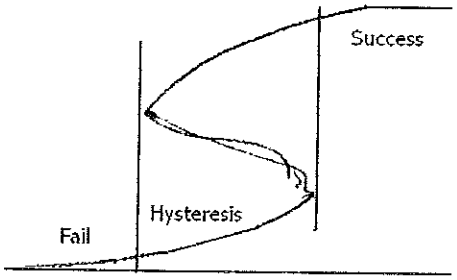


Fig. 1. Bistability and hysteresis in motor learning.

Hysteresis between critical points is the result of two forces on the person (gradients). Difficulty pushes the behavioral outcome toward the fail threshold, and skill pushes the behavior toward success, as shown in Fig. 2. Csikszentmihalyi's concept of flow is useful as an explanation for the a continuous fluid behavioral sequence, whereby the learner masters a level of success and then proceeds to a more demanding level of challenge. A rule of thumb seems to be that 20% more demand results in a 50% success rate, which provides optimum challenge for the individual.

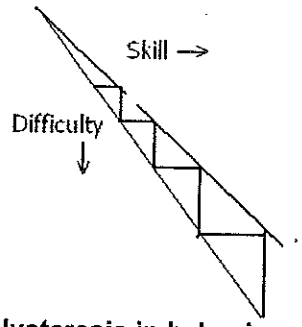


Fig. 2. Hysteresis in behavior produced by challenge and skill while learning.

It is parenthetically noteworthy that cusp and butterfly catastrophe models have been useful in modeling learning processes since 1978 for animals and humans (Guastello, 1995, 2002). Another approach to learning dynamics involves chaotic processes leading to self-organization (Li, Krauth, & Huston, 2006). In either case it is gratifying to see new research built on nonlinear foundations.

Emergency response. In a later session, Stephen Guastello presented the latest installment to the swallowtail catastrophe model of leadership emergence. The new application pertained to emergency response situations, where the ER teams were assumed to be working relatively independently of any command and control hierarchy. The experimental groups played a board game (The Creature that Ate Sheboygan) where an ER team of police, military, and firefighting personnel worked to contain the damage in a city produced by a Godzilla-type monster. Teams and adversaries made dynamical decisions during each turn of the game. Coordination among the players was necessary, but unlike previous studies on coordination and leadership, ER teams worked within a Stag Hunt utility structure instead of an Intersection structure.

Once again the social structure of the teams self-organized into primary and secondary leaders and non-leaders. Leaders separated from non-leaders as a result of a broad range of traits that would correspond to Kauffman's K in an N|K distribution; prominent among these characteristics was a strong competitive behavior against the adversary. Within the zone of leadership, leaders came to the foreground in situations where group sizes were larger (9 to 12 teams members compared to 4 to 7); the larger groups tended to perform better against the adversary than smaller ones. Primary leaders distinguished from secondary leaders to the extent that the group was indeed successful.

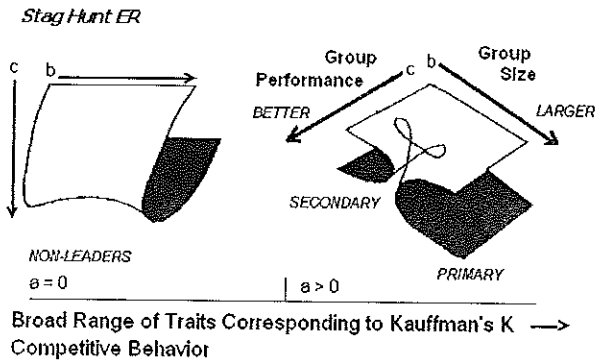


Fig 3. Swallowtail catastrophe model for leadership emergence in emergency response teams.

Gaming utilities. Masuda Naoki investigated the best means of setting utilities in games to promote maximum cooperation in the long run. There is apparently a trade-off between cost to participate and utilities affecting cooperation such that situations with lower entry costs promote more cooperation than higher entry costs, all other things being equal. The effect of entry costs was more pronounced in Prisoners' Dilemma than in Stag Hunt.

Episodic memory. In our third plenary session for the weekend, Ichiro Tsuda presented the progress in the understanding of the role of the hippocampus in episodic memory. Chaos and fractal principles are both involved. One type of study involved the activity of place neurons. Rats first learned they way around a square terrain and a round terrain. The previous learning facilitated their movement around an intermediate shape, such as an octagon. Here there was a notable phase transition between the previous and new learning.

Fig. 4. Basic phase transition.

We are accustomed to thinking of memories in a network, such as the one in Fig. 5. A retrieval cue activates one memory node, which could activate others adjacent to it to greater or lesser extents. The formation, dissolution and reformation of memory nodes have never been explained particularly well, and Tsuda appears to be unraveling the mysteries of the process with alacrity.

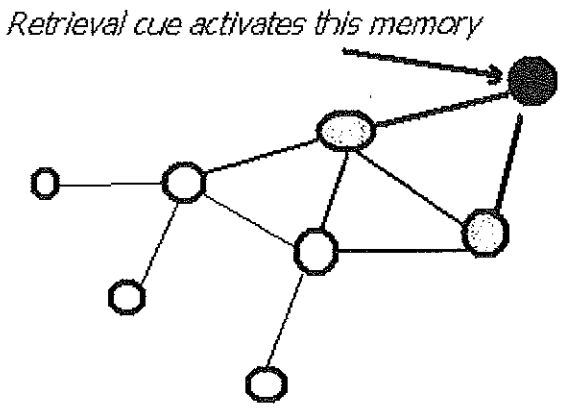


Fig. 5. Standard image of a memory network.

Each memory nodes acts as an attractor to other memory nodes. Each memory item is best described as a Milnor attractor, which has a leak in its basin as shown in Fig. 6. The leak is needed to form the link between one node and another to form a network. A simulation in a 2-D array shows that point clusters form, similarly to the cluster in the middle of Fig 7, with points clustering elsewhere in the field. The clusters naturally form and dissolve in the course of the iterations.

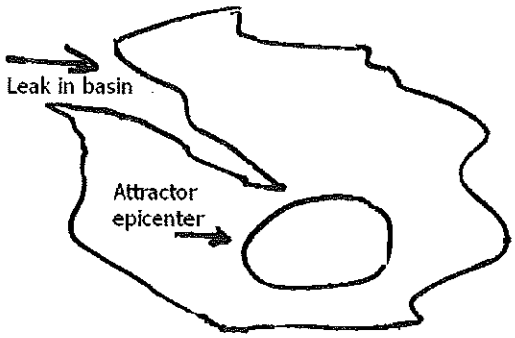


Fig. 6. Milnor attractors form the basis of memory nodes.

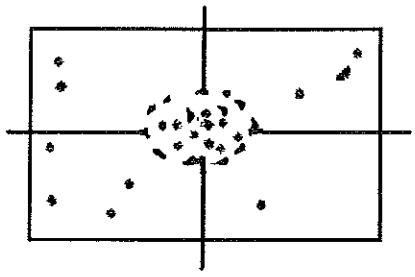


Fig 7. Attractor clusters form and dissolve.

We usually think of the depolarization and repolarization of neurons during the firing process as simple discrete events, such as the textbook-type rendition in Fig. 8, solid black lines. There is considerable variability taking place over time during the period that are usually assumed to be solid, which in turn may contain the information necessary to explain encoding and decoding content or thoughts. If we expand the array in Fig. 7 to 3-D, Tsuda surmises that episodic memories are encoded as Cantor sets of the membrane potential shortly before neurons fire. Episodic memories are then decoded in the pulse trains of the post-firing phase.

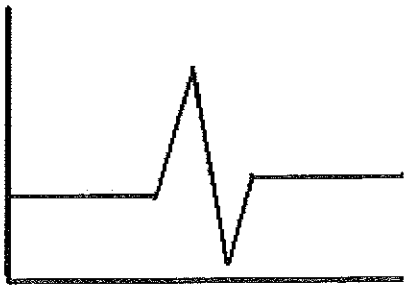


Fig. 8. Traditional neuron firing representation may contain more information than previously assumed.

Traffic in Boston. Moving on to other types of networks, Haoong Jeong examined other types of networks, with particular attention to traffic patterns in the city of Boston, USA. The legendary six degrees between any two people or places can be hard to identify sometimes, and there is often a cost associated with accessing a link. As a result, a traffic pattern that might look optimal from the vantage point of the global system can be seriously suboptimal with regard to individual utilities. Thus traffic flows can become very clogged in spite of the best intentions of designers.

Aging Processes. This reporter will not fathom a guess regarding how many years one takes off one's life being stuck in traffic, but Tarynn Witten's presentation on genetic networks and aging processes suggests that we might be able to figure out the answer someday soon. There seems to be a tendency for people to think of genes for this and that acting independently of other genes, yet at the same time we know that multiple gene explanations for biological outcomes are often needed where single-gene explanations are inadequate. According to Witten, genes are actually organized in networks. If one applies some basic graph theory, one can readily notice that some nodes are more central than others. Genes that are located in more central positions will have a larger impact on physiology if their connections to other genes are disturbed.

The number of connections per gene follows a power law distribution. The $1/f^{\alpha}$ relationship is more prominent in healthy systems. With aging, the distribution conforms less to a power law. At the present time it is not conclusive how much of the deviation from a power law is represented by poor statistical fit overall (R^2), or by the particular values of the shape parameter. The research team has been using nonlinear regression with their small samples to assess these two metrics, so their approach does allow a separation between the effects of the two values, which is not possible using the linear regression method.

Service Sciences. In a unique contribution to the program, Kozuyosh Hidaka from IBM Japan Ltd. Explained IBM's interest in developing university curricula on service sciences. He noted the growth in the service industry sector in recent decades, and the role of an IT-related knowledge base in contemporary services. Service businesses differ from durable goods in that the product is intangible, and more

closely related to the providers' actions than to products per se. There is also a simultaneity of production and consumption, which is decoupled in the production of durable goods.

Hidaka presented a long list of topics that could be studied in a service science curriculum, including data quantity and quality issues, real-time computing, stochastic modeling, client innovation, self-service technologies, service support, and scientific approaches to design and analysis. Complexity theory was implicated at the point of scaling a service from small to massive; SCTPLS members could probably brainstorm numerous ways in which nonlinear science would be relevant to data-oriented services and information flows.

The educational goal of a service science curriculum is to develop "T-shaped people:" People with a broad spectrum of knowledge on the one hand, but with a specialty in something particular. This idea is not appreciably different from the educational strategy of most Arts and Sciences colleges – broad knowledge and distribution of requirements alongside a major discipline – but with the content more centered on operations management themes.

The conference program also contained two more symposia on service sciences chaired by Akira Namatame. Agent-based modeling and network analysis were prominent in those sessions.

Cognitive processes in aiming movements. It's not as simple as pushing a button. Psychologists have known since the late 19th century that two velocities are involved in aiming movements, such as pushing a button on a control panel or positioning a tool to a target. The first portion of the movement is relatively fast, and the second is slower as the person comes in for the proverbial landing. The process was codified as Fitts Law in the mid-1950s, whereby movement speed was the result of distance to the target and the width of the target. Complex targets make the analysis all the more complicated and movements less concisely predictable, according to Jagacinski and Flach (2003).

It now appears that Andre Valdez and Eric Amazeen have made some important headway in explaining the change in movement speeds. Their experiment showed $1/f^{\alpha}$ distributions of movement time when participants could work at their preferred speed, but the $1/f^{\alpha}$ pattern dissipated when they were compelled to move more quickly. The two cognitive processes of planning followed by control explain the phenomenon, such that unhurried movements allow for an overlap of the planning and control features giving rise to the $1/f^{\alpha}$ distribution, whereas hurried movements do not engage the same overlap. Valdez and Amazeen's study is now published (2008).

Collective Intelligence. Bill Sulis made the case that early decision models and those based on Simon's concept of bounded rationality did not go far enough to explain the type of cognition that appears to take place at the collective level. Using ants, which are social insects, as a model, Sulis captured the growing number of principles behind collective intelligence. Here it is best to refer to his forthcoming book chapter (Sulis, in press) for extended explications.

Temperament and Personality. In the final session of the conference, Irina Trofimova described her research program in temperament and personality. After a brief run-though of trait theory from Allport to the Big Five, she explained a research program initiated by Pavlov that is less widely known in the West. Pavlov was studying types of nervous systems, which differ according to their excitability, a heating effect, and their inhibition types, a cooling effect, which is manifest in social and motor systems. One is reminded of the Bernard cell. Types undergo bifurcations with learning and development, giving rise to development in what we recognize as an adult personality. The empirical task is to connect characterizations of excitability and inhibition to the Big Five personality traits.

There is reason to believe that Trofimova is on the right track. Grigsby and Stevens (2000) offered a similar thesis based on the temperament types identified by Thomas as Chess, and the nonlinear studies of the development of stability in neural pathways with learning and experience, as developed by Walter Freeman.

Sashimi deluxe. The banquet Friday night featured a wide range of classic Japanese recipes, and a breathtaking presentation. The sashimi display, shown on the back cover of this *Newsletter* (photo by Dimitrios Stamovlasis) was perhaps the visual centerpiece. Yuji Aruka explained that the presentation was designed as Japanese rock garden, which we have recently learned has an implicit fractal structure (van Tonder, 2006).

References

Aoki, M. (2007). *Reconstructing macroeconomics*. New York: Cambridge University Press.

Dore, M. H. I., & Rosser, J. B., Jr. (2007). Do nonlinear dynamics in economics amount to a Kuhnian paradigm? *Nonlinear Dynamics, Psychology, and Life Sciences, 11*, 119-148.

Grigsby, J., & Stevens, D. (2000). *Neurodynamics of personality*. New York: Guilford Press.

Guastello, S. J. (1995). *Chaos, catastrophe, and human affairs*. Mahwah, NJ: Lawrence Erlbaum Associates.

Guastello, S. J. (2002). *Managing emergent phenomena*. Mahwah, NJ: Lawrence Erlbaum Associates.

Jagacinski, R. J., & Flach, J. M. (2003). *Control theory for humans*. Mahwah, NJ: Lawrence Erlbaum Associates.

Li, J-S., Krauth, J., & Huston, J. P. (2006). Operant behavior or rats under fixed-interval reinforcement schedules: A dynamical analysis via the extended return map. *Nonlinear Dynamics, Psychology, and Life Sciences, 10*, 215-240.

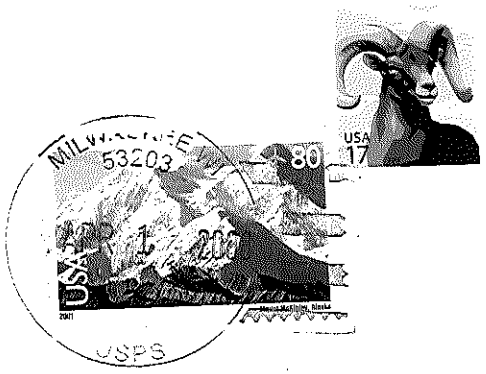
Sulis, W. (in press). Collective intelligence: Observations and methods. In S. J. Guastello, M. Koopmans, & D. Pincus (Eds.), *Chaos and complexity in psychology: Theory of nonlinear dynamical systems*. New York: Cambridge University Press.

Valdez, A., & Amazeen, E. L. (2008). Using 1/f noise to examine planning and control in a discrete aiming task. *Experimental Brain Research*, 10.1007/s00221-008-1305-0.

van Tonder, G. J. (2006). Cover images: Visual structure in Japanese rock gardens. *Nonlinear Dynamics, Psychology, and Life Sciences, 10*, 143-146.

If undeliverable, return to

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



FIRST CLASS AIRMAIL EVERYWHERE

Your current issue of the
NEWSLETTER of The Society for Chaos Theory
in Psychology & Life Sciences!