Society for Chaos Theory in Psychology & Life Sciences

NEWSLETTER

Vol. 20, No. 2
January, 2013

Society for Chaos Theory in Psychology & Life Sciences

23rd Annual Conference
Portland State University, Portland (OR)
July 25-27, 2013

CALL FOR PAPERS AND SYMPOSIA

A. Steven Dietz
Conference Chair

We invite interested scholars to present and discuss recent developments in nonlinear dynamical system theory, which includes chaos theory, fractals, complex systems and related topics. Over the years, the annual conferences of the Society for Chaos Theory in Psychology & Life Sciences have inspired and supported scholars from an array of disciplines to look at new ways to develop their theoretical and empirical work in an integrated approach to life sciences.

The Society for Chaos Theory in Psychology and Life Sciences is a multidisciplinary organization. The topics covered by the conference include applications of nonlinear dynamics theory and techniques to problems encountered in any area of the behavioral, social and life sciences including psychology, sociology, economics, econophysics, management sciences, anthropology, aesthetics, education, biology, physiology, ecology, neuroscience and medicine. One or more of the following nonlinear concepts must be an explicit part of the presentation: attractors, bifurcations, chaos, fractals, solitons, catastrophes, self-organizing processes, cellular automata, agent-based models, network analysis, genetic algorithms and related evolutionary processes, dynamical diseases, or closely related constructs. The broad mixture of the disciplines represented here indicates that many bodies of knowledge share common principles.

The Annual Conference of the Society for Chaos Theory in Psychology and Life Sciences is the premier venue for training, networking, and sharing the latest empirical and applied developments in nonlinear dynamics across psychology, the life sciences and beyond. For 23 years, the Society and its conferences have been founded in the principles of interdisciplinary work, acknowledging the ubiquity of nonlinear dynamics across the behavioral, social, and life sciences. The conference is typically intimate in size. Attendance is typically broad geographically as well, with membership in SCTPLS representing each of the global continents.

The program will include workshops, invited addresses, 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. We continue to encourage all nonlinear scientists, including graduate students who might be finishing up a dynamical thesis or dissertation, to share their ideas through paper presentations, chairing a roundtable session, or by proposing other alternative presentation formats, such as posters, product demonstrations, short workshops, or debates around controversial topics.

VENUE

Conference Center

Our meetings will be held at the beautiful campus of **Portland State University, Portland OR**, in the heart of the region of the country informally known as Ecotopia. We will be using the newly renovated facilities of the **University Place Hotel and Conference Center** for our conference meetings and primary lodging location. Additional information about these facilities and local attractions will be posted to the lodging page or the local logistics page of this conference web site.

INSTRUCTIONS FOR ABSTRACTS

Abstracts should be between 150-250 words for posters, individual papers, short workshops and other alternative formats. The connection to nonlinear dynamics, chaos, complexity, fractals or related concepts should be clear to the reader. Include organizational affiliation and contact information on each speaker or author.

Abstracts may be up to 500 words for symposia or panel discussion. 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. Symposia should present current research within a coherent theme defined by the title and abstract.

For experimental work, the background, aims and framework, methods and samples, results, conclusions and Implications should be clear to the reader. For theoretical work, the background, aims and framework, mode of inquiry, outcomes, conclusions and implications should be clear to the reader.

Abstracts for panel discussions should provide a brief overview of the topic, and indicate the relevant background of the panelist 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).

Abstracts 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. Where applicable, the abstract should emphasize skills that attendees can expect to acquire. 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). Also, please indicate on the submission form which of the following categories is representative of your submission:

Check all that apply: 1) Empirical (e.g., presentation of empirical results of a study), 2) Theoretical (e.g., empirically testable theoretical development), 3) Applied (e.g., organizational, business, product development or marketing, or involving clinical interventions), 4) Quantitative (e.g., computational or statistical modeling); 5) Qualitative (e.g., non-quantitative analysis of empirical data); 6) Philosophical or artistic (e.g., epistemology, philosophy of science, aesthetics, or audio-visual demonstrations)." Each person submitting is limited to a maximum of two presentations as first author. It is acceptable to be a co-author on additional work submitted by others.

Abstract should be submitted electronically by visiting:
http://www.societyforchaostheory.org/conf/2013/cfp.cgi

****Trouble submitting?**** If your submission is rece1ved successfully you will be taken to a confirmation page, with a link to follow for any future edits. If you have repeated trouble making your submission, as a back-up option please feel free to send all of the relevant submission information directly to Steven Dietz: scarver103@gmail.com , the conference chair, who can make sure that your submission is successfully loaded into the system.

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*), *JEL/Econlit, MathSciNet,* and other important databases. *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.*NDPLS* accepts manuscripts all through the year, but please use October 1, 2013 as the target date for submitting conference-related papers; the journal would like to have as many articles based on conference presentations as possible ready for the same issue.

We look forward to seeing as many of you there as possible!
Warmest regards,

A. Steven Dietz, SCTPLS President-Elect & Conference Chair, Texas State University; **David Pincus, Ph.D.,** Chapman University, SCTPLS President; **Stephen J. Guastello, Ph.D**., Marquette University, SCTPLS Conference Committee; **Sara Nora Ross, Ph.D.,** Antioch University, SCTPLS Secretary; **Dick Thompson, Ph.D**., High Performance Systems, Watkinsville, GA, SCTPLS Past-President; **Wayne Wakeland**, Portland State University, SCTPLS Conference Committee.

Important Dates

December 17, 2012. Call for proposals opens.

March 23. Early-bird abstract submissions will receive a reply after this date.

April 30. Call for proposals closes.

May 15. All acceptances finalized by Program Chair.

June 8. Your hotel reservations need to be made by this date in order to ensure the special conference rate. Please see LODGING & HOTEL RESERVATIONS for further details.

July 1. All speakers with papers accepted for presentation must register (with payment in full) by this date in order to remain on the program. The early registration rates are in effect until this date. Please note that hotel reservations and conference registration are two separate tasks.

July 5. If you are bringing an additional guest to the banquet Friday night who is not registered for the SCTPLS conference, please let us know so we can keep the headcounts straight with the caterers. You can use the conference registration form to make these arrangements and payments.

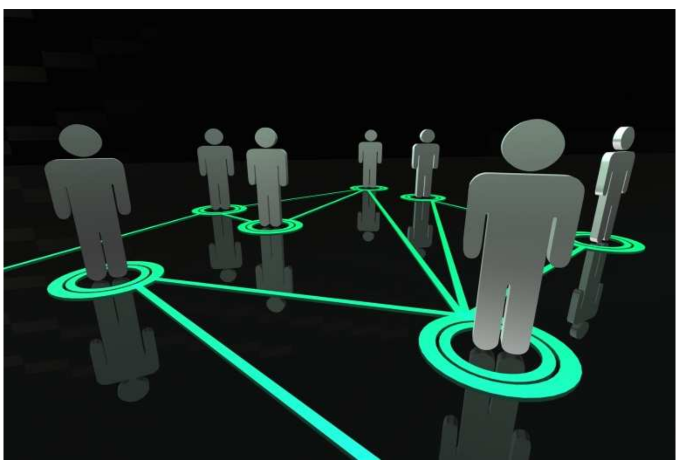
July 25. Preconference workshop on nonlinear methods. Conference opens with the Sunset Session in the early PM with a special guest speaker (TBA).

July 26. Conference day with paper, colloquia, special formats. SCTPLS Banquet in the PM with special guest speaker (TBA).

July 27. Conference day and SCTPLS Business Meeting.

Nonlinear Networks Linked-in

by **David Pincus**, President SCTPLS



This fall the society started a LinkedIn site. Under the leadership of new Membership Committee Member Adam Kiefer, the site was opened to help members connect and exchange information more easily. The other committee members (Caroline Fielden, Shana Narayan, and Victoria Gaetan) expressed hope and enthusiasm that the site would prove especially useful for linking potential research collaborators, for linking students with faculty mentors, and for linking recent graduates with jobs that support their skills in nonlinear dynamics research and technology. The site has made a good start so far. There was an initial burst of 41 members joining in the first two weeks and then leveling to around one addition per week. We currently have 53 members, representing about one in six of the broader organization. We have not made the page visible to the public yet in order to build a hub of members first to promote quality discourse and content over quantity.

The future of our presence together on LinkedIn will depend upon how it serves us, individually and collectively. But until then, the membership committee and I are encouraging you to join and give it a try. You can simply hold the link for future use, contribute a question, or perhaps share a bit of your work with others. John Kolm has made some exemplary contributions recently, posting full power-point slide presentations along with audio for his most interesting work on the dynamics underlying corporate extinction. Once I have the time to sit down and figure out how to do this myself, I'd like to follow his lead and post a presentation or two of my own from prior conference talks ☺.

One of the nice things about LinkedIn is that these contributions will persist and grow over time, so that when we do make the site more public, it can serve as a growing and evolving repository of our collective work – each of us at the forward fringe of our sub-disciplines. To join, simply log-in to your linkedIn account, search for SCTPLS, and click the "join" link.

Finally, we'd like to remind members of other existing on-line resources. It is my sense that the web-site tends to be under-utilized – particularly the resources page. If you are looking for introductory material for colleagues, software packages, definitions of terms and links to other on-line sources then the SCTPLS site is the place to go. Although it hasn't been very active, the society does still have a Facebook page as well, which you can join by simply logging on and sending a request. And for all you members in the southern half of the universe, Caroline Fielden is leading a fairly active SCTPLS Australia Facebook effort. Please join feel free to join her and the rest down there.

Looking forward to Linking with more of you in 2013 and beyond…

David Pincus, President SCTPLS

NDS in ERGONOMICS Research

Reported by **Stephen Guastello**, Marquette University

Nonlinear dynamics made several appearances at the 56th Annual Conference of the Human Factors and Ergonomics Society in Boston, Oct. 22-26, 2012. Several SCTPLS members (Polemnia Amazeen, Aaron Likens, Ron Stevens, Stephen Guastello) participated in a discussion panel on team dynamics along with Jamie Gordon (Texas Tech University) and Nancy Cooke (chair, Arizona State University). Several themes were covered by the discussants:

1. How to recognize temporal signatures of NDS processes in behavioral data and what NDS analytic techniques work best for answering particular types of questions.
2. There is a need to tease apart individual skills and other contributions from group effects that cannot be reduced to individual contributions.
3. Teams events can evolve over time, and situations change over time. Is it possible to observe patterns of neural synchrony over time?
4. How do the patterns of synchrony reflect readiness, and what answers are forthcoming from wavelet analysis or recursion plots?
5. Untangling the effects of cognitive workload, fatigue, practice, and task switching is challenging at the individual level as more than one NDS process is involved. The issues only complicate further when team processes such as coordination, group size, and hierarchical structure are involved (Cooke et al., 2012).

Time (10 minutes each) only permitted the panelists to pose questions for the audience that they were trying to answer in their research programs. Some of their new material is appearing in the January 2013 issue of *NDPLS* (Guastello et al., 2013; Stevens et al., 2013), and more is expected to appear elsewhere soon. Figure 1 is a sample from Aaron Likens' presentation on wavelet analysis of EEG readings. The goal of the project is to associate NDS metrics with work performance events where the group overcomes roadblocks, adapts to situation changes, and so forth. The upper portion of Fig. 1. is an entropy measurement which shows notable drops at key points in the group's activity, based on data from Stevens' study (see feature article in this issue of the *Newsletter*). The lower potion of Fig. 1. shows that the fractal structure at the individual level is different from the fractal structure at the group level, implying a multifractal structure. Observations at time-stamp 2000 and 3000 correspond to changes in the experimental task.

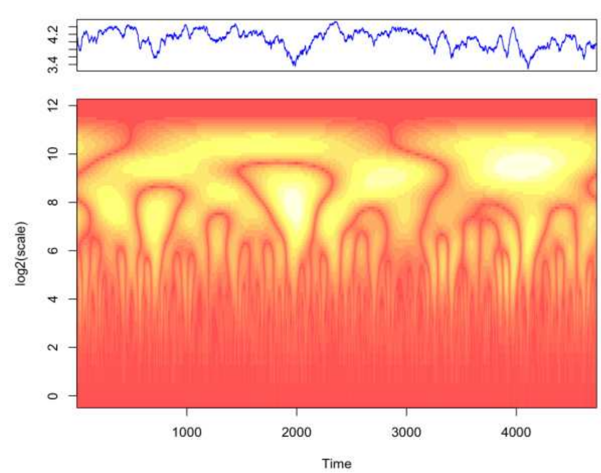


Fig. 1. The top panel is an entropy time series for one representative team. The bottom panel is the result of multifractal analysis (a continuous wavelet transform) of the same series.

There were two other contributions to nonlinear group dynamics the next day. Strang et al. (2012) examined the conversations of air force teams under different workload contributions using sample entropy. The first question to examine was whether the content, role (who speaks), or combination of both reflected the most critical information. They found that only content was affected, showing lower sample entropy in temporal regularity in conversations transpiring under more stressful conditions. An interesting discussion point was that lower entropy in many contexts is interpreted as less adaptive. Here the lower entropy might actually reflect an adaptive response as the team members became more entrained on each other. This point invites further research.

Russell et al. (2012) analyzed a similar data set for 5-person teams with recursion plot analysis, looking for percent determinism in content, team role, and combined categories as a function of whether the group had radio contact only or augmented tools, high versus low demand, and teams that were cross-trained in the various roles versus control teams. They found some complex interactions overall that also invite further follow-up. One interesting point, nonetheless, was that percent determinism was less for cross-trained groups with the augmented technology. "This suggests that cross-training teams displayed a slightly more chaotic communication structure [when they had] access to additional communication tools (i.e. chat and a virtual whiteboard)" (p. 471).

And that's not all! NDS found its way into the journal *Human Factors* three times this year. In January, a review of studies on group workload (Funke et al., 2012) described the attempts to integrate behavioral, subjective, and biometric data from individuals to ascertain a group-level measure of workload. Conventional approaches to the problem have not produced a great deal of theoretical clarity or generalizable results. Funke et al. (2012) suggested that NDS, with its constructs of synchronicity and self-organization, offers strong potential for solving the problem.

The nonlinear contribution in the October issue was about the cusp catastrophe models for cognitive workload and fatigue (Guastello et al., 2012). It followed a special section on new automation devices in automobiles such as automatic breaking when the distance between leading and following cars gets too short, or the cars slide horizontally out of their lanes. Although the devices seem to work as intended, they free up the driver's attention to devote to non-driving tasks that are using regarded as driver distractions. Oops?

The December issue featured the keynote papers from the 18th Triennial Congress of the International Ergonomics Association. Waldemar Karwowski's contribution (2012) featured chaos, self-organization and synchronization in complex person-machine systems. Sensitivity to initial conditions apparently occurs more often than most human factors engineers seem to realize. Perhaps they are getting the hang of it now, however. It will be interesting to see their further uptake on NDS ideas in the near future.

References

Cooke, N. J., Amazeen, P. G., Gorman, J. C., Guastello, S. J., Likens, A., & Stevens, R. (2012). Modeling the complex dynamics of teamwork from team cognition to neurophysiology. *Proceedings of the Human Factors and Ergonomics Society, 56*, 183-187.

Guastello, S. J., Boeh, H., Schimmels, M., Gorin, H., Huschen S., Davis, E., Peters, N. E., Fabisch, M., & Poston, K. (2012b). Cusp catastrophe models for cognitive workload and fatigue in a verbally-cued pictorial memory task. *Human Factors*, *54*, 811-825.

Guastello, S. J., Boeh, H., Gorin, H., Huschen, S., Peters, N. E., Fabisch, M., & Poston, K. (2013). Cusp catastrophe models for cognitive workload and fatigue: A comparison of seven task types. *Nonlinear Dynamics, Psychology, and Life Sciences, 17,* 23-47.

Karwowski, W. (2012). A review of human factors challenges of complex adaptive systems: Discovering and understanding chaos in human performance. *Human Factors, 54*, 983-995.

Russell, S. M., Funke, G. J., Knott, B. A., & Strang, A. J. (2012). Recurrence quantification analysis used to assess team communication in simulated air battle management. *Proceedings of the Human Factors and Ergonomics Society, 56*, 468-472.

Stevens, R., Gorman, J. C., Amazeen, P., Likens, A., & Galloway, T. (2013). The organizational neurodynamics of teams. *Nonlinear Dynamics, Psychology, and Life Sciences, 17,* 67-86.

Strang, A. J., Horwood, S., Best, C., Funke, G. J., Knott, B. A., & Russell, S. M. (2012). Examining temporal regularity in categorical team communication using sample entropy. *Proceedings of the Human Factors and Ergonomics Society, 56*, 473-477.

Feature Article

The Emergence of Team Neurodynamics

by ***Ron Stevens****, Ph.D.*
IMMEX Project/UCLA School of Medicine
The Learning Chameleon, Inc.

As team members interact, turbulent flows of information organize periodically around a common goal only to change form again with the task and the environment. Within the context of this coordinated team activity the communication linkages and synchronizations among team members extend beyond speech to include, gestures, postures and physiologic systems that span biological processes and broader societal activities (Drew, 2005; Ashenfelter, 2007; Shockley, Santana & Fowler, 2003; Gorman, Amazeen, & Cooke, 2010; Guastello, Pincus & Gunderson, 2006).

It is not surprising that neurophysiologic events are the underpinnings of these dynamics, yet it is only recently that their evolving dynamics in real-world teamwork settings have begun to be modeled (Stevens, Galloway, Berka & Sprang, 2009; Stephens, Silbert, & Hasson, 2009; Dumas, Nadal, Soussignan, Martinerie & Garnero, 2010). This is in part due to the lack of portable and robust neurophysiologic monitoring systems. Equally important has been the need to extend neurophysiologic studies of teams from the relatively short and controlled environments with repetitive tasks, to continuous monitoring in real-world settings with longer-lasting tasks. Advances in both areas have led to the emerging field of team neurodynamics.

Electroencephalography (EEG) is the tool of choice for studying team neurodynamics. EEG is the recording of electrical activity of the brain at different regions along the scalp and the rhythmic patterns in the electrical oscillations from different brain regions contain signals representing complex facets of brain activity. While EEG has traditionally been viewed as a tool for studying individual cognition in the milliseconds to seconds range, multiple investigators are extending this range to include teams operating over minutes or hours in military, educational and corporate environments. Given the complexity of both the teamwork systems and the underlying neurophysiologic measures, a nonlinear dynamical analytic framework would seem appropriate for guiding the studies.

Two complementary approaches are steering these efforts. The first seeks to establish linkages between specific neuromarkers and different behavioral, cognitive or emotional states; an example is the phi complex that may distinguish states of effective and ineffective social coordination (Tognoli, Lagarde, DeGuzman, & Kelso, 2007). These high spectral EEG neuromarkers show a topology consistent with the neuroanatomical location of the human mirror neuron system that is thought to respond during actions taken, as well as during the observed actions of others. Unlike EEG signatures that appear and disappear in response to many stimuli (e.g. P300), neuromarkers like the phi complex exist at a higher level of abstraction and are more targeted to subsets of behaviors. Such neuromarkers may not be precise analogs of the multiple ways that can be used to describe interactions or aspects of cognition but are close enough approximations to be useful for a better understanding of teamwork.

The use of such previously defined EEG neuromarkers for Engagement (EEG-E) or Workload (EEG-WL) (Berka, Levendowski, Cvetinovic, Petrovic, Davis, 2004) has been the approach used by Stevens et al (Stevens, Galloway, Berka, Behneman, Wohlgemuth, Lamb & Buckles, 2011; Stevens, Galloway, Wang, & Berka, 2012) to investigate team neurodynamics in settings as diverse as Submarine Piloting and Navigation by Navy teams and high school students scientific problem solving. In these studies symbolic representations of team neurodynamic states are created from raw EEG streams by extracting the EEG-E features and then normalizing and partitioning the levels from each member into high, average and low values. These are assigned 3, 1 and -1 respectively and aggregated into a vector representing the state of the team (Fig. 1). These vectors are used by unsupervised artificial neural network (ANN) classification methods to create a symbolic state space showing the possible states of a team. As examples, some Neurodynamic Symbols (NS) may represent times when most team members had low EEG-E, others when most members had high EEG-E and others representing other combinations of EEG-E .

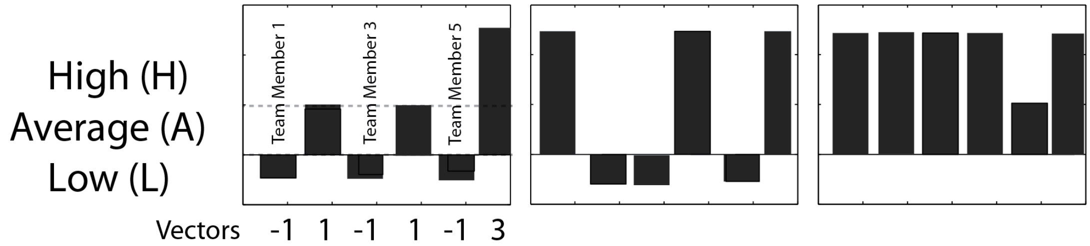


Figure 1. Sample Neurodynamic Symbols. Within each symbol are six histograms representing the level of a cognitive marker that is being expressed by each member of a six person team at a particular second. The dotted lines indicate high, average and low level values. Each symbol is assigned a vector indicating the state of each person (-1 = low, 1 = average and 3 = high) and the resulting team vectors are used as inputs for ANN classification.

When analyzed and classified over a performance or series of performances these vectors create a symbolic state space showing the combinations of EEG-E across members of the team (Fig. 2A). The sequential NS stream of a performance provides the data source for subsequent study. The structure of the NS data stream can be shown in transition matrices that plot the NS at time *t* against that at *t+1.* The diagonal structure in (Fig. 2B) indicates that most second-by-second neurodynamics changes are local; randomization of the NS stream destroys the structure (Fig. 2C).

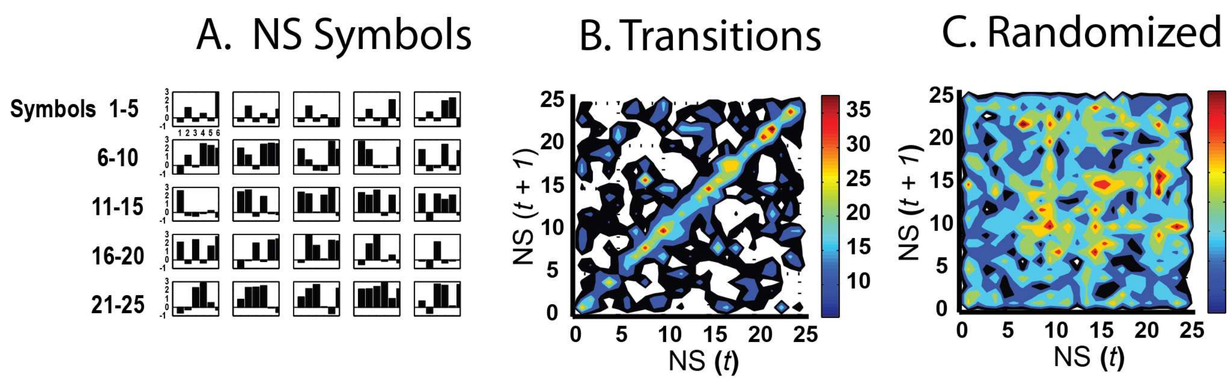


Figure 2. Structural Properties of Neurodynamic Symbols. A) Symbolic state space generated by training an unsupervised ANN with a 5150 second NS stream from a six-person team. B) Transition matrix of the NS data in (A). C) Transition matrix of (B) that was randomized.

For studying teamwork, the hypothesis was that statistical regularities existed in the NS data stream that represented the task and team actions at each point in time and that these could be detected by sequential changes in the NS distribution. In this way, the second-by-second sequence of symbols that arise during teamwork may contain information much the way that words in a sentence or the codons in nucleic acids contain information.

This temporal history can be quantified by measuring the fluctuations in Shannon entropy of this symbol stream over a sliding history window (Shannon & Weaver, 1949). Entropy is a quantitative measure of the 'amount of mix' in the NS data streams. For instance, if a data stream had a random mix of 25 symbols the entropy would be 4.64. If the number of symbols in the data stream window was restricted to 12 of the 25 (i.e. much more organized), the entropy level would drop to 3.58. The entropy values provide no information *per se* on the nature of the organization, only that there was greater or lesser organization. The specifics of the organization however can be deduced from the transition matrices and symbolic state space maps.

It is natural to think that major task changes would cause a change in the team organization. Submarine Piloting and Navigation (SPAN) is well suited for studying such changes as SPAN simulations are required high fidelity navigation training tasks at the Naval Submarine School in Groton, CT, that contain three task segments. The Briefing presents the overall goals of the mission and is followed by the Scenario, a dynamically evolving task containing both easily-identified and less well-defined teamwork processes. The Debriefing segment is a discussion of the team's strengths and challenges. Figure 3 shows the NS frequencies and transition matrices for a SPAN session which has been decomposed into the three segments.

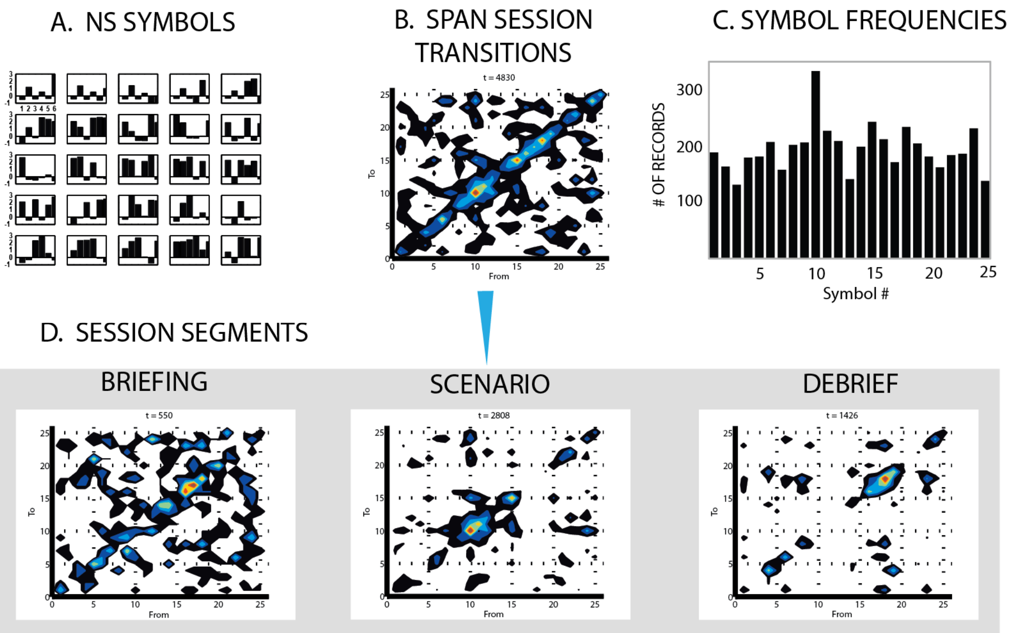


Figure 3. Sub-task Distributions of Neurodynamic Symbols and Transitions. The top level shows the twenty-five NS state space (A), the transition matrix (B), and the symbol frequencies (C) for a SPAN session. The matrices in (D) show the transitions for the three major segments of the task.

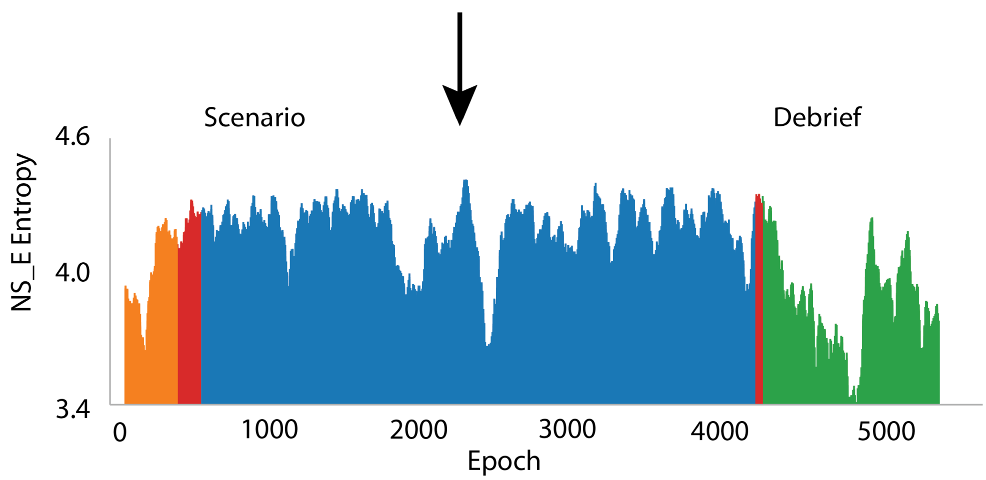


Figure 4. NS Engagement Entropy Profile. Periods of team organization are identified within a NS time series by measuring Shannon's entropy over a 100 second sliding window that was updated each second.

The overall Session transition matrix (Fig. 3B) showed the greatest variety of transitions. There was a prominent diagonal in the matrix indicating that most second-to-second changes in NS expression were small and local. The presence of the diagonal was not surprising as a linear architecture was used for the unsupervised neural network which clustered similar symbols close together (Fig. 3A). The Scenario and Debriefing segments (Fig. 3D) each showed highly restric–ted transition profiles to the extent that the diagonal structure was almost lost.

The Scenario should contain the most interesting team re-organizations as the effects of prior navigation decisions begin to accumulate and change (limit?) future options. In Fig. 4 at the time indicated by the arrow the submarine was navigating in the fog while transiting a difficult stretch of water and oncoming shipping was forcing the submarine to deviate from their operations plan. This created uncertainty for the team and one result was the increased organization as indicated by the decreased NS entropy. Such NS entropy fluctuations are not unique to SPAN tasks but are frequent in other tasks where they often occur around periods of increased stress or intense discussion. Further details can be found in (Stevens, 2012) and at www.teamneurodynamics.com

It is not unusual for dynamical systems (i.e. financial markets, local ecologies, biochemical systems) to have significant fluctuations yet there is often no quantitative way of identifying them, predicting them, or estimating how long they will last. As outlined in Fig. 5 the measures relating to the dynamics of NS fluctuations may provide this opportunity.

These ideas are in part based on our earlier studies showing that experienced navigation teams have higher overall NS entropy levels than navigation teams in training (Stevens et al, 2012) implying that the experienced teams should have fewer NS entropy fluctuations (Fig. 5E), fluctuations of decreased magnitude (Fig. 5A) and / or shorter duration (Fig. 5B) compared with teams in training.

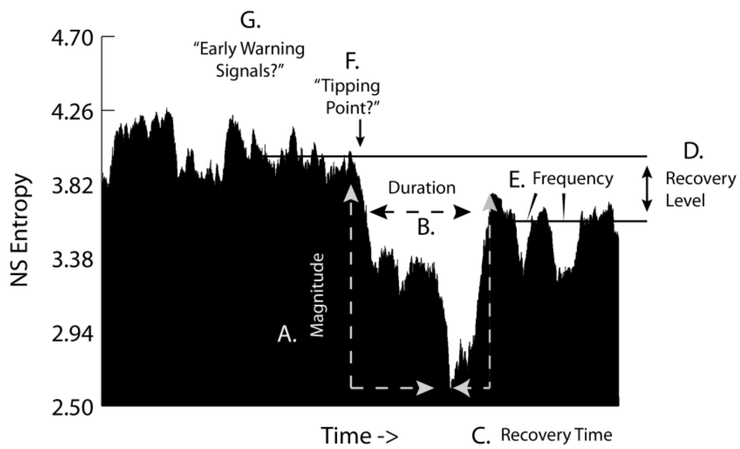


Figure 5. Potentially Useful Metrics of NS Entropy Fluctuations.

This figure is also derived in part from observations like those in Fig. 4 showing that the largest magnitude / duration fluctuations occurred around stressful periods. The Recovery Time (Fig. 5 C) is considered the time needed for the team to return to their normal operating rhythm and organization after a perturbation to the system and along with the Recovery Level (Fig. 5D) may provide an important indication of team resiliency. In Fig. 5, the team remained in a more organized state (as indicated by the lower entropy) after a Recovery than they were in before the perturbation. Finally, the idea of a tipping point (Fig. 5F) stems from the work of Scheffer (2009) on Critical Transitions. The idea here is that gradual changes to the system, not overtly obvious, increase the system fragility to the point that a small additional change propels the team to a tipping point and a transition to an alternative state or regime shift. If so, Early Warning Signals (Fig. 5 G.) may potentially exist upstream that would provide a predictive horizon, a feature that would be very useful for monitoring team function and training.

The future for team neurodynamics seems bright as it is possible to envisage libraries of EEG (and other) biomarkers that broadly represent the range of cognitions, emotions, and social behaviors that would be differentially represented in military, commerce and educational teams. Integrated models of these measures may help us better understand, at multiple systems and levels, what it means for a team to be 'in the groove' or 'out-of-synch'.

Ashenfelter, K. (2007). Simultaneous analysis of verbal and nonverbal data during conversation: symmetry and turn-taking. Unpublished thesis, University of Notre Dame.

Berka, C., Levendowski, D. J., Cvetinovic, M. M., Petrovic, M. M., Davis G., Lumicao, M.N. (2004). Real-Time analysis of EEG indexes of alertness, cognition, and memory acquired with a wireless EEG headset. *International Journal of Human-Computer Interaction.* Lawrence Erlbaum Associates, Inc. 17(2), 151-170.

Drew, P. (2005). Conversation analysis. In Fitch & Sanders (Eds.). Handbook of language and social interaction. Mahwah, N.J. Lawrence Erlbaum. 71-102.

Dumas, G., Nadel, J., Soussignan, R., Martinerie, J., and Garnero, L. (2010). Inter-brain synchronization during social interaction. *PlosOne* 5 (8) e12166 doi : 10 1371/journal.pone0012166.

Gorman, J. C., Amazeen, P. G., & Cooke, N. J (2010). Team coordination dynamics. *Nonlinear Dynamics, Psychology, and Life Sciences, 14,* 265-289.

Guastello, S.J., Pincus, D., and Gunderson, P.R. (2006). *Nonlinear Dynamics, Psychology and Life Sciences, 10,* 365-399.

Scheffer, M. (2009). Critical Transitions in Nature and Society. Princeton and Oxford. Pr—inceton University Press, 2009.

Shockley, K., Santana, M.V., & Fowler, C. A. (2003). Mutual interpersonal postural constraints are involved in cooperative conversation*. Journal of Experimental Psychology: Human Perception and Performance* 29 (2), 326-332.

Shannon, C., & *theory of communication.* Urbana: University of Illinois Press.

Stephens, G., Silbert, L., and Hasson, U. (2009). Speaker-listener neural coupling underlies successful communication. *Proc. Nat. Acad. Sci*. 106 (26) 10841-10846.

Stevens, R. H., Galloway, T., and Berka, C., & Sprang, M. (2009). Can neurophysiologic synchronies be detected during collaborative teamwork? *Frontiers of Augmented Cognition: Proceedings: HCI International 2009,* D. Schmorrow & I. Estabrook, M. Grootjen (Eds.) LNCS 5638 pp. 271-275. Springer-Verlag, Berlin, Heidelberg, 2009.

Stevens, R., Galloway, T., Berka, C., Behneman, A., Wohlgemuth, T., Lamb, J., and Buckles, R. (2011). Linking models of team neurophysiologic synchronies for engagement and workload with measures of team communication. In *Proceedings of the 20th Conference on Behavior Representation in Modeling and Simulation.* (11-BRIMS-019). The BRIMS Society, Centerville, OH.

Stevens, R., Gorman, G. (2011). Mapping cognitive attractors onto the dynamic landscapes of teamwork *Proceedings of the 14th International Conference on Human-Computer Interaction*. D. Schmorrow & C. Fidopiastis (Eds.) LNCS 6780 pp. 366-375. Springer-Verlag, Berlin, Heidelberg, 2009.

Stevens, R.H., Galloway, T., Wang, P., and Berka, C. (2012). Cognitive neurophysiologic synchronies: What can they contribute to the study of teamwork? *Human Factors 54,* 489-502.

Tognoli, E., Lagarde, J., DeGuzman, G., and Kelso, J.A.S. (2007). The phi complex as a neuromarker of human social coordination. *Proc. Nat. Acad. Sci*. 104,8190-8195.

Nonlinear Dynamical Bookshelf

Chatelin, F. (2012). *Qualitative computing: A computational journey into nonlinearity*. Singapore, World Scientific. High technology industries are in desperate need for adequate tools to assess the validity of simulations produced by ever faster computers for perennial unstable problems. In order to meet these industrial expectations, applied mathematicians are facing a formidable challenge summarized by these words – nonlinearity and coupling. This book is unique as it proposes truly original solutions: (1) Using hypercomputation in quadratic algebras, as opposed to the traditional use of linear vector spaces in the 20th century; (2) complementing the classical linear logic by the complex logic which expresses the creative potential of the complex plane. The book illustrates how qualitative computing has been the driving force behind the evolution of mathematics since Pythagoras presented the first incompleteness result about the irrationality of √2. The celebrated results of Gödel and Turing are but modern versions of the same idea: the classical logic of Aristotle is too limited to capture the dynamics of nonlinear computation. Mathematics provides us with the missing tool, the organic logic, which is aptly tailored to model the dynamics of nonlinearity. This logic will be the core of the "Mathematics for Life" to be developed during this century. *Contents:* Introduction to Qualitative Computing, Hypercomputation in Dickson Algebras, Variable Complexity within Noncommutative Algebras, Singular Values for the Multiplication Maps, Computation Beyond Classical Logic, Complexification of the Arithmetic, Homotopic Deviation in Linear Algebra ,The Discrete and the Continuous, Arithmetic in the Four Dickson Division Algebras, The Real and the Complex, The Organic Logic of Hypercomputation, The Organic Intelligence in Numbers.

Coffman, J. A., & Mikulecky, D. C. (Eds.). (2012). *Global insanity: How homo sapiens lost touch with reality while transforming the world*. Litchfield Park, AZ: Emergent Publications. ISBN 9781938158049. 160 p. The Global Economy that sustains the civilized world is destroying the biosphere. As a result, civilization, like the Titanic, is on a collision course with disaster. But changing course via the body politic appears to be well nigh impossible, given that much of the populace lives in denial. Why is that? And how did we get into such a fix? In this essay, biologists James Coffman and Donald Mikulecky argue that the reductionist model of the world developed by Western civilization misrepresents life, undermining our ability to regulate and adapt to the accelerating anthropogenic transformation of the world entrained by that very model. An alternative worldview is presented that better accounts for both the relational nature of living systems and the developmental phenomenology that constrains their evolution. Development of any complex system reinforces specific dependencies while eliminating alternatives, reducing the diversity that affords adaptive degrees of freedom: the more developed a system is, the less potential it has to change its way of being. Hence, in the evolution of life most species become extinct. This perspective reveals the limits that complexity places on knowledge and technology, bringing to light our hubristically dysfunctional relationship with the natural world and increasingly tenuous connection to reality. The inescapable conclusion is that, barring a cultural metamorphosis that breaks free of deeply entrenched mental frames that made us what we are, continued development of the Global Economy will lead inexorably to the collapse of civilization.

Gerrits, L. (2012). *Punching clouds: An introduction to the complexity of public decision-making.* Litchfield Park, AZ: Emergent Publications. ISBN 9781938158001. 250 p. Why is it that many large public projects run out of control in terms of scope, budget and time? How can it be explained that urban regeneration programs are highly successful in one neighborhood but fail to deliver in an adjacent neighborhood? Why is it that public policies can return unexpected and sometimes even unwanted outcomes, despite meticulous planning? Why is public decision-making such a complex affair? The world is an erratic place, full of surprises, some of which are wanted and others are unwanted. Public decision-making in this world is like punching clouds: considerable energy is put into the punching but the cloud goes its own way, despite the punches. Recent ideas and insights from the complexity sciences improve our understanding of the intricate nature of public decision-making. This book offers a bridge between the study of public decision-making in the domain of Public Administration on the one hand, and the complexity sciences on the other hand. It is aimed at (doctoral) students and scholars in Public Administration who are curious about how the complexity sciences can inform the analysis and understanding of public decision-making. The book introduces important concepts such as systems, non-linear dynamics, self-organization and coevolution, and discusses their relevance to public decision-making. It also proposes a case-based research method for researching this complexity.

Gerrits, L. & Marks, P. (Eds.). (2012). *COMPACT I: Public Administration in Complexity.* Litchfield Park, AZ: Emergent Publications. ISBN 9781938158018. 406 p. There is an argument that says that research in Public Administration is always about social complexity. This argument is true. There is also an argument that says that Public Administration is actually very little informed by complexity. This is equally true. The differences lie in the different takes on complexity. The latter approach understands that comprehension of complexity requires a specific theoretical framework and associated tools to look into the black box of causality. The authors in this edited volume gathered in Rotterdam (The Netherlands, June 2011) to discuss how the complexity sciences can contribute to pertinent questions in the domains of Public Administration and Public Policy. Their contributions are presented in this edited volume. Each contribution is an attempt to answer the Challenge of Making Public Administration and Complexity Theory work—COMPACT, as the title says. Together, they present an overview of the diverse state of the art in thinking about and research in complex systems in the public domain.

Jörg, Ton (2011). *New thinking in complexity for the social sciences and humanities: A generative, transdisciplinary approach*. New York: Springer ISBN 978-94-007-1302-4. This book focuses on the development of new thinking in complexity and on the tools needed for this new thinking, i.e. the development of a new language for complexity. This new language is very much about how a nonlinear complex reality is part of real-world complexity. We can start thinking in complexity about the complex topics of our social sciences and humanities by making use of this new language. With the new tools and the new language, it will be possible to deal with the complexity of real-world complexity and to show the promise of harnessing complexity, by turning complexity into effective and advantageous complexity for our social sciences and humanities. It is the very potential of complexity as self-potentiating which makes complexity so beneficial for viewing and doing social sciences. The new tools and the new thinking in complexity may be considered to be the warp and woof of a new science of complexity.

McCarter, B. G., & White, B. E. (2012). *Leadership in chaordic organizations*. Auerbach Publications. 318p. Supplying a clear vision of how to build high-performance teams, Leadership in Chaordic Organizations presents methods for improving operations through the application of complex systems engineering principles and psychological counseling techniques. Ideal for systems engineers, organizational managers, coaches, and psychologists, it addresses the fundamental issue of the human condition in systems development. The book considers the dynamic variables inherent in the human condition and how they impact group dynamics. Helping you to demystify complex system behaviors, it details an approach to leadership that integrates elements of neurobiology, systems engineering, complexity science, philosophy, and evolutionary and social psychology. It defines complexity and its impact on the organization and also explains how conflict can actually be constructive in group settings. Sharing helpful tips on how to build trust in today's environment, the book also: (a) describes how the human condition affects group dynamics, (b) lays out current problems and outlines workable solutions, (c) shares a new vision of high-performance teams (d) Illuminates theory with applications. Illustrating what teams and collaborative groups look like in a decentralized environment, the text introduces a highly effective group communications process invented by Richard Knowles—describing its use in designing 3D Immersive Learning Environments that enable complex emergence in dynamic interactive simulations. It also discusses complex human systems (Wicked Problems) and the potential of multi-user virtual environments to provide the transformative vision needed to fully engage all employees in your drive to make your organization more effective, efficient, and sustainable.

Phillipson, P. E., & **Schuster, P. (2012).** ***Modeling by nonlinear differential equations*****. Singapore: World Scientific.** This book aims to provide mathematical analyses of nonlinear differential equations, which have proved pivotal to understanding many phenomena in physics, chemistry and biology. Topics of focus are autocatalysis and dynamics of molecular evolution, relaxation oscillations, deterministic chaos, reaction diffusion driven chemical pattern formation, solitons and neuron dynamics. Included is a discussion of processes from the viewpoints of reversibility, reflected by conservative classical mechanics, and irreversibility introduced by the dissipative role of diffusion. Each chapter presents the subject matter from the point of one or a few key equations, whose properties and consequences are amplified by approximate analytic solutions that are developed to support graphical display of exact computer solutions. *Contents*: Processes in closed and Open Systems, Dynamics of Molecular Evolution, Relaxation Oscillations, Order and Chaos, Reaction Diffusion Dynamics, Solitons, Neuron Pulse Propagation, Time Reversal, Dissipation and Conservation.

Sajjadi, S. G. (2013). Dynamics of Water Waves: Selected Papers of Michael Longuet-Higgins. Volumes 1 – 3. Singapore: World Scientific. ISBN 978-981-4322-51-5. 1950p. This is a three-volume selection of classical papers by Michael Longuet-Higgins, who for many years has been a leading researcher in the fast-developing field of physical oceanography. Some of these papers were first published in scientific journals or in conference proceedings that are now difficult to access. All the papers are characterized by the novelty of their content, and the clarity of their style and exposition.

Schiff, S. J. (2012). ***The emerging intersection between control theory and neuroscience*****. Cambridge, MA: MIT Press.** Over the past sixty years, powerful methods of model-based control engineering have been responsible for such dramatic advances in engineering systems as autolanding aircraft, autonomous vehicles, and even weather forecasting. Over those same decades, our models of the nervous system have evolved from single-cell membranes to neuronal networks to large-scale models of the human brain. Yet until recently control theory was completely inapplicable to the types of nonlinear models being developed in neuroscience. The revolution in nonlinear control engineering in the late 1990s has made the intersection of control theory and neuroscience possible. In Neural Control Engineering, Steven Schiff seeks to bridge the two fields, examining the application of new methods in nonlinear control engineering to neuroscience. After presenting extensive material on formulating computational neuroscience models in a control environment--including some fundamentals of the algorithms helpful in crossing the divide from intuition to effective application--Schiff examines a range of applications, including brain-machine interfaces and neural stimulation. He reports on research that he and his colleagues have undertaken showing that nonlinear control theory methods can be applied to models of single cells, small neuronal networks, and large-scale networks in disease states of Parkinson's disease and epilepsy. With Neural Control Engineering the reader acquires a working knowledge of the fundamentals of control theory and computational neuroscience sufficient not only to understand the literature in this transdisciplinary area but also to begin working to advance the field. The book will serve as an essential guide for scientists in either biology or engineering and for physicians who wish to gain expertise in these areas.

The Bookshelf Compilation

The Bookshelf is composed of items that people remember to send to us through various channels. Sometimes we find them ourselves. Have you written a new book on dynamics topics? Read one lately? You know where to send the book information or reviews. Please make the citation information as complete as possible.

This edition of the Bookshelf includes an upward compilation of all the books we have listed starting April, 2005, one issue after our previous upward compilation, and includes the books that were listed for the first time in this issue. It's been a long time, obviously. The plan for this issue of the *Newsletter* is to start at the beginning of the alphabetical listing of authors until we run out of space and then continue in the next issue of the NL as space permits. This exercise contains the citations only. For the descriptive blurb, see the earlier *Newsletters* if you have them; otherwise, check the publisher's web site.

We encourage our readers to browse the list carefully. As we compile the list, we cannot help but ask ourselves, "How did I miss, or forget about, that?!" We hope you can share the job of re-discovery. SCTPLS has promoted the development of nonlinear science worldwide for more than two decades now. One trick of the trade starts with finding good ideas and passing them around. So here we go …

ADA – DOD

Adamatzky, A. (2001). *Computing in nonlinear media and automata collectives*. Boca Raton, FL: CRC Press.

Adamatzky, A. (2010). *Physarum machines: Computers from slime mould.* Singapore: World Scientific.

Agnew, N. M., & Pyke, S. W. (2007). *The science game: An introduction to research methods in the social and behavioral sciences.* (7th ed.). Toronto: Oxford University Press.

Alexander, V. N. (2011). *The biologist's mistress: Rethinking self-organization in art, literature, and nature.* Litchfield Park, AZ: Emergent Publications.

Allaire, G. (2007). *Numerical analysis and optimization: An introduction to mathematical modeling and numerical simulation*. Oxford, UK: Oxford University Press.

Allen, P., Maguire, S., & McKelvey, B. (Eds.). (2011). *The Sage handbook of complexity and management*. Thousand Oaks, CA: Sage.

Allen, P., Richardson, K. A., & Goldstein, J. A. (Eds.). (2011*). Emergence: Complexity & organization, vol. 11*. Litchfield Park, AZ: Emergent Publications.

Allen, P. M., Richardson, K. A., Goldstein, J. A., & Snowden, D. (Eds.). *Emergence, complexity and organization, vol. 9.* Mansfield MA: ISCE.[1]

Almendro, M. (2003). *Chaos psychology*. Spain: Vitoria-Gasteiz.

Anischenko, V. S., Astakhov, V., Neiman, A., Vadivasova, T., & Schimansky-Geier, L. (2007). *Nonlinear dynamics of chaotic and stochastic systems: Tutorial and modern developments*. New York: Springer.

Aruka, Y. (Ed.). (2011). *Complexities of production and interacting human behavior*. Tokyo: Physica-Verlag-Springer.[2]

Attwater, R., & Merson, J. (Eds.). (2007). *Sustaining our social and natural capital: Proceedings of the 12th ANZSYS Conference*. Norwood, MA: ISCE Publications.[3]

Ausloos, M., & Dirickx, M. (Eds.). (2005). *The logistic map and the route to chaos: From the beginnings to modern applications*. Berlin: Springer.

Aziz-Alaoui. M., & Bertelle, C. (Eds.). (2008). *Emergent properties in natural and artificial dynamical systems*. New York: Springer.

Baglio, S., & Bulsara, A. (Eds.). (2006). *Precise applications of nonlinear dynamics*. New York: Springer.

Bainbridge, W. S. (2006). *God from the machine*. New York: Springer.

Balagué, N. & Torrents, C. (2011). *Complejidad y deporte (Complexity and sport)*. Barcelona: INDE.

Barillot, E., Calzone, L., Hupe, P., Vert, J.-P., & Zinovyev, A. (2012). *Computational systems biology of cancer*. Boca Raton, FL: Chapman & Hall/CRC.

Barnett, W., Deissenberg, C., & Feichtinger, G. (Eds.). (2004). *Nonlinear dynamics, multi-agent economies, and learning*. Amsterdam: Elsevier.

Barnsley, M. F. (2006). *Superfractals, patterns of nature*. New York: Cambridge University Press.

Berglund, N. (2010). *Noise-induced phenomena in slow-fast dynamical systems: A sample-paths approach*. New York: Springer.

Birta, I. G., & Arbez, G. (2007). *Modelling and simulation: Exploring dynamic system behaviour*. New York: Springer.

Boccaletti, S., Latora, V., & Moreno, V. (Eds.). (2010). *Handbook on biological networks*. Singapore: World Scientific.

Braha, D., Minai, A. A., & Bar-Yam, Y. (Eds.). (2006). *Complex engineered systems: Science meets technology*. New York: Springer.

Bratteli, O., & Jorgensen, P. (2002). *Wavelets through a looking glass*. San Francisco: Birkhauser.

Brilliger, D. et al. (Eds.). (1984). *Time series of irregularly observed data*. New York: Springer.

Brown, R. C. (2012). *The tangled origins of Leibnizian calculus: A case study of a mathematical revolution* Singapore: World Scientific.

Brunner, E.J., Tschacher, W. & Kenklies, K. (eds.) (2011). *Selbstorganisation von Wissenschaft [Self-organization of science]*. Jena, Germany: Verlag IKS Garamond.

Busaki, G. (2006)*. Rhythms of the brain*. New York: Oxford University Press.

Busemeyer, J., & Diederich, A. (2010). *Cognitive modeling*. Thousand Oaks, CA: Sage.

Buss, D. (2007). *Evolutionary psychology: The new sciences of the mind.* Boston, MA: Allyn & Bacon.

Callebraut, W., & Rasskin-Gutman, D. (Eds.). (2005). *Understanding the development and evolution of natural complex systems*. Cambridge, MA: MIT Press.

Capra, F., Sotolongo, P., & van Uden, J. (Eds.). (2007). *Reframing complexity: Perspectives from the north and south*. Norwood, MA: ISCE Publishing.[4]

Carleson, L., & Gamelin, T. W. (2007). *Complex dynamic*s. New York: Springer.

Carroll, R. J., Ruppert, D. Stefanski, L. A., & Crainiceanu, C. M. (2006). *Measurement error in nonlinear models: A modern perspective* (2nd ed.). Boca Raton, FL: Chapman & Hall/ CRC Press.

Cencini, M., Cecconi, F., & Volpiani, A. (2009). *Chaos: From simple models to complex systems*. Hackensack, NJ: World Scientific.

Chacon, R. (2005). *Control of homoclinic chaos by weak periodic perturbations*. Singapore: World Scientific.

Chatelin, F. (2012). *Qualitative computing: A computational journey into nonlinearity*. Singapore, World Scientific.

Chater, N., & Oaksford, M. (Eds.). (2008). *The probabilistic mind: Prospects for Bayesian cognitive science*. Oxford, UK: Oxford University Press.

[1] Now located in Litchfield Park, AZ, currently continued as Emergent Publications

[2] Available from Springer, New York and elsewhere.

[3] Now located in Litchfield Park, AZ, currently continued as Emergent Publications.

[4] Now located in Litchfield Park, AZ, currently continued as Emergent Publications.

Chen G., & Huang, Y. (2011). *Chaotic Maps: Dynamics, Fractals, and Rapid Fluctuations.* San Rafael, CA: Morgan & Claypool.

Chen, K., & Wang, L. (2006). *Trends in neural computation*. New York: Springer.

Chen, S-H., Jain, L., & Tai, C-C. (Eds.). (2006). *Computational economics: A perspective from computational intelligence*. Hershey, PA: IGI Global.

Chua, L. O. (2011). *A nonlinear dynamics perspective of Wolfram's new kind of science, vol. 4*. Singapore: World Scientific.

Chua, L. O. (2012). *A nonlinear dynamics perspective of Wolfram's new kind of science, vol. 5.* Singapore: World Scientific.

Coffman, J. A., & Mikulecky, D. C. (Eds.). (2012). *Global insanity: How homo sapiens lost touch with reality while transforming the world*. Litchfield Park, AZ: Emergent Publications.

Collet, P., & Eckmann, J. P. (2006). *Concepts and results in chaotic dynamics: A short course*. New York: Springer.

Conte, E. (2012). *Advances in application of quantum mechanics in neuroscience and psychology: A Clifford algebraic approach.* Hauppauge NY: Nova Science.

Cooper, S. B. (2004). *Computability theory*. Boca Raton, FL: Chapman & Hall.

Cox, D. R., & Solomon, P. J. (2002). *Components of variance*. Boca Raton, FL: CRC Press.

Crassidis, J. L., & Junkins, J. L. (2004). *Optimal estimation of dynamic systems*. Boca Raton, FL: Chapman & Hall/CRC/Taylor & Francis.

Crowe, B. J. (2005). *Music and soulmaking: Music therapy and complexity science*. Lanham, MD: Rowman & Littlefield/Scarecrow Press.

Daveney, R. L., & Keen, L. (2006). *Complex dynamics: Twenty-five years after the appearance of the Mandelbrot set.* Providence, RI: American Mathematical Society.

Dawkins, R. (2005). *The ancestor's tale: A pilgrimage to the dawn of life*. UK: Phoenix.

DeLeuze, G. (2005). *Pure immance: Essays on a life*. Cambridge, MA: MIT Press.

Dennard, L., Richardson, K. A., Morcol, G. (Eds.). (2008). *Complexity and policy analysis: Tools and concepts for designing robust policies in a complex world.* Mansfield, MA: ISCE.[5]

Diamond, J. (2005). *Collapse: How societies choose to fail or survive*. New York: Viking Penguin.

Dimitrov, V. (2003). *A new kind of social science: Study of self-organization of human dynamics*. UK: Lulu.com

Dimitrov, V. (2005). *Introduction to fuzziology: Study of fuzziness of knowing*. UK: Lulu.com

Dimitrov, V., & Hodge, B. (2002). *Social fuzziology: Study of fuzziness of social complexity*. New York: Springer.

Dimitrov, V., & Korotkich, V. (Eds.). (2002). *Fuzzy logic: A framework for the new millennium*. New York: Springer.

Dimitrov, V., & Naess, T. (2005). *Wholesome life ecology: How to live wholesomely in a society that is killing the planet.* UK: Lulu.com

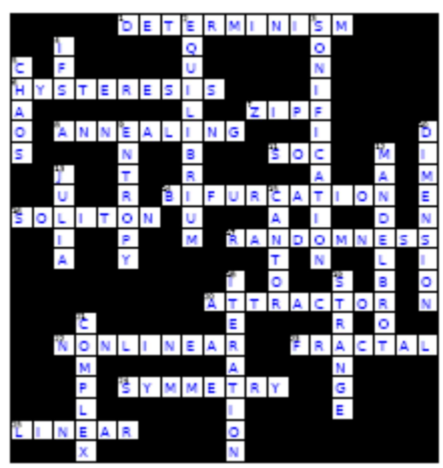
Dodds, J. (2011). *Psychoanalysis and ecology at the edge of chaos: Complexity theory, Deleuze-Guattari and psychoanalysis for a climate in crisis*. Oxon, UK: Routledge.

[5] Now located in Litchfield Park, AZ, currently continued as Emergent Publications.

Time to enjoy our Annual Poster. 2013's is here.

Do not be satisfied with this sneak preview. The real deal (in color) will be circulated to active members through the SCTPLS listserver. Meanwhile, you can also enjoy some of Amanda Moore's other fascinating images here: www.amanda-moore.artistwebsites.com

Solution to Crossword Puzzle #1 (*SCTPLS Newsletter*, October, 2012):



If undeliverable, return to:
Society for Chaos Theory in Psychology & Life Sciences
P. O. Box 484, Pewaukee, WI 53072 USA

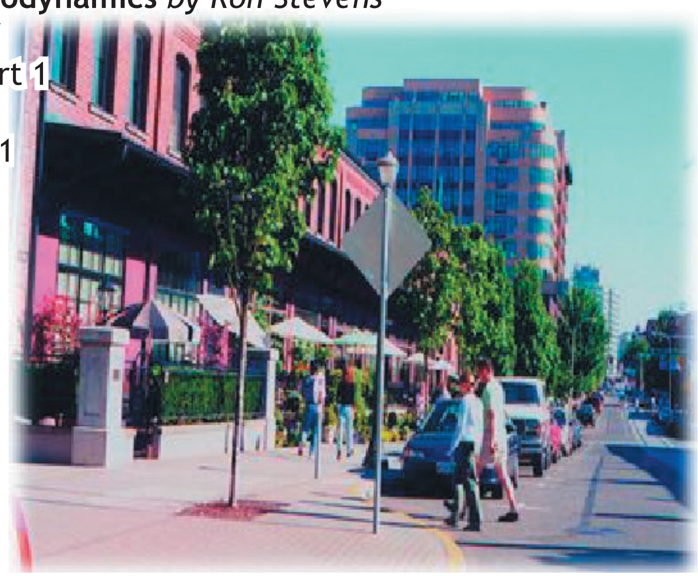
FIRST CLASS AIRMAIL EVERYWHERE

CONTENTS THIS ISSUE

Call for Papers:

The 23rd Annual
International Conference Portland State University,
Portland Oregon, July 25-27, 2013

Nonlinear Networks on Linked-in
NDS in Ergonomics Research
Feature Article:
The Emergence of Team Neurodynamics *by Ron Stevens*
Nonlinear Dynamical Bookshelf
The Bookshelf Compilation, part 1
2013 Annual Poster
Solution to Crossword Puzzle #1



Gaetano L. Aiello, Editor
Stephen J. Guastello, Production Editor
Fractal Roses by J. C. Sprott