Chaos & Complexity Theory

Inside…

AERA
Chicago!

Late Breaking:

Due to an error, two of our sessions appear twic in the program schedule. See the session stories for details.

Dr. U. R. Sigmember

Attend the (Real) General Meeting and Demonstration

Our real "business" meeting will again be on Wednesday from 6:15—7:45 at the Hyatt West Tower 3rd. *The program contains two dates for this meeting. We will not be meeting Tuesday night!*

Come and bring a friend. Potential members are encouraged to join us for the evening! This session will be our best chance to "mix" and get to know our colleagues in the SIG and locate common interests. Reserve some time to sit and talk with other members—that interaction can be the most exciting of the meeting.

At the business meeting we will be reporting on the group's progress during the last year and conducting SIG business. There should be a brief preview of the coming events as well.

When the more technical details are completed—and our president rolled through this chore quickly last year— we will have a demonstration of Poincaré Maps by Russ Marion.

Dr. Marion is an associate professor in the department of Educational Leadership at Clemson. He is associated with Clemson Research Institute for the Study of Complex Social Systems (CRISCSO). He will demonstrate one of the newer methodological offsprings of chaos and complexity theories: Poincaré maps. As Dr. Marion explains it a Poincaré map is one way to examine the periodicity of attractors. He likens the map to a composite picture of the points that would be captured by a strobe light as an attractor is being drawn.

There are two especially attractive features of Poincaré maps according to our demonstrator: the way that they isolate the discrete time periods that are so important in our social world and the relative simplicity of the mathematics involved. They can be an accessible tool for those without an extensive mathmatics background.

Dr. Marion will extend his discussion to the techniques of modified Pointcaré maps, which have interestingly fractal characteristics, and to return maps.

The demonstration should be fascinating; the examples will be drawn from datasets ranging from the stock market to school absenteeism.

Reflections

LOOKING BACK: LAST YEAR'S MEETING

COMMENTS FROM THE PROGRAM CHAIR

Looking back at last year's roundtable presentations, symposia, and talk by Jeff Goldstein, I am encouraged by our first meetings and look forward to the upcoming ones in Chicago. Last year I was especially impressed by the variety we had — phase diagramming, language arts and complexity, and seven very enthusiastic roundtables. With seven roundtables submitted, and scheduled at the same time (not our doing, that of AERA), I was nervous about attendance. However, the attendance and especially the strength of interest was very high. There is obviously a need for our SIG and I hope we have something to offer. There is no doubt that chaos/complexity offers a new way to view learning, social groupings and interactions, and research paradigms.

Looking forward to our upcoming meeting, we seem to have an increased membership — hence allowing us two symposia. Some themes will be learning, classroom and curriculum, school reform, administration, and nonlinear models for research designs. All in all this should be another exciting meeting.

William Doll, Louisiana State University

SIG Symposia: Tuesday & Wednesday

"CHAOS AND COMPLEXITY AS METHODOLOGICAL TOOLS." SHERATON, PARLOR C, LEVEL 3. TUE., 4:05-6:05.
"CHAOS AND COMPLEXITY THEORY AT THE SCHOOL GATE: UNRAVELING THE POTENTIAL OF THE NEW SCIENCES."
HYATT, FIELD, WEST TOWER, 3RD. WED., 2:15-4:15 ALSO SHERTON, ONTARIO, LEVEL 2,THUR., 4:05-6:05

Tuesday

The SIG has two symposia on the plate this year. The first, on Tuesday, is chaired by David Kirshner of Louisiana State University and focuses on the methodological uses of chaos and complexity with a special focus on understanding learning. Two papers are featured.

John St. Julien (*caveat emptar*—the writer of this article) will pursue the idea that complexity theories comprise a significantly different approach to doing science in his paper: "Complexity: Developing a More Useful Analytic Framework for Education?" Arguing that because linear reductionism has not served education well, particular qualities of the newer, still-in-formulation analytic emerging from complexity theories hold great promise for both research and practice in education, using learning as an example.

David Yaden and Lillian Greely work to disentangle —or perhaps reentangle— the relationship of human learning to two genre forms common in education: the storybook and the socratic dialogue. Their paper, "Chaos as a Methodological Tool: Exploring the Topology of Conversation and the Intentional Learning Process in Parent-Child Storybook Reading and the Philosophical Dialectics," is also interesting for its extension of phase-space diagrams discussed in last year's business meeting.

Wednesday & Thursday

Note:: Due to duplications in the program this session will be presented twice. The second symposium is chaired and organized by Rick Ginsburgh of Colorado State University. The presenters will speak briefly. This will be followed by a series of questions addressed to the *audience* by the session's facilitator, surely a turnaround from the traditional organization.

The real attraction of this session will be the wide range of ideas and topics explored by the presenters and the dynamic interplay of ideas with the audience during the discussion period.

Listing some of the topics and sources may give a sense of the array that can be anticipated: systems thinking, the Enlightenment, Calvinist Protestantism, Francis Bacon and fractals, elementary classroom practices, and school leadership. The titles are enticing:

- The New Sciences and Systemic Change — *Ali Carr*
- The Analytics of Complexity: Beyond the Enlightenment or Back to the Future? — *John St. Julien*
- Teaching in a Nonlinear Mode — *William Doll*
- ESL Writing: Ideas as Fractals — *Robert Kahn*
- School Reform: Establishing Dialogic Communities as Self-Organizing Structures for Reflection, Critique, and Change — *Jayne Fleener*
- Schools as Complex Adaptive Systems: Implications for the Next Generation of Readers — *Lars Bjork*

Rich Roundtables: Wednesday

"CRITICAL ISSUES IN CHAOS AND COMPLEXITY THEORY." SHERATON BALLROOM II, LEVEL 4. 9:35-10:15.

The Chaos and Complexity roundtables set a rich feast for the SIG. Roundtables provide a chance to sit and talk with the authors about their work in a way that is seldom possible in symposia. The diversity and vitality of the offerings this year are a testament to the broad appeal of chaos and complexity theories.

- **Looking at Chaotic Events Through Life Cycle Concepts of Organizations.** *Whitney B. Berta, University of Toronto.* Table 26.
- **Side-by-Side: A Condition for Self-Organization of Learning.** *Kathleen Martin, Texas Christian University.* Table 27.
- **Achievement Motivation as a Dynamical System.** *Dan Rea, Georgia Southern University.* Table 28.
- **Patterns in Chaos: Implications for Learning.** *Sherrie B. Reynolds, Texas Christian University.* Table 29.
- **Chaos in the Classroom: An Application of Chaos Theory.** *JoAnn Trygestad, University of Minnesota.* Table 30.
- **Attending to the Noise: Applying Chaos Theory to School Reform.** *Richard D. Wertheimer, Pittsburgh Public Schools.* Table 31.

INTEGRATED (AND INCOMPLETE) LEARNING

In our efforts to demonstrate the relevance of chaos and complexity theory to education, we are winning—not quickly, but gradually; not because we have 125 members, but because our ideas are taking hold. The relevance of chaos and complexity theory to reading and literacy (Weaver, 1985), to educational reform (Fullan, 1993), to the curriculum (Doll, 1993), to organizations (Wheatley, 1992; Wheatley & Kellner-Rogers, 1996), to cognitive psychology (Smith & Thelen, 1993; Thelen & Smith, 1994), and to language learning (Lightfoot, 1991, p. 163) has been staked out. Now is the time for the foundations to be solidly laid for the buildings that are to come.

However, we should recognize that the paradigm shift that is occurring is not according to the misleading model of Thomas Kuhn, but according to the dynamic model of Larry Laudan (1984, pp. 63, 76) in which changes in methods, theories and aims occur piecemeal but rationally, as the interaction within any network of learning becomes clearer over time. I like to call this "integrated learning," because there is no single cause and effect, rather thereare emerging patterns in which the complexity of change is evident. Already, our aims are framed more in terms of "complexity" than "chaos," while the resulting theories are looking for "self-organization," not simply "activity that looks random but is not."

Almost all of us are committed to interdisciplinary research; and we should recognize that it is in the application of tools from one discipline to another that the strongest ideas often emerge, strengthening both disciplines. For example, the application of the mathematical tools of chaos theory is already changing psychology (Vallacher & Nowak, 1994; Eiser, 1994) and economics (Medio, 1992). Furthermore, it is encouraging to see that easily readable records of how chaos and complexity theory is changing different disciplines are now available (Hall, 1992; Mullin, 1993). Why not pick and choose what is of interest, instead of feeling guilty that any personal knowledge base is limited? As the Renaissance scholar Richard Waswo (1987) has mused:

> Academic specialization is something we often complain of and seldom do anything about. The professional rewards are surer, the intellectual risks fewer, if we remain securely within the institutional confines and mystique of expertise…

The consequences, however, of cultivating only our small and neatly fenced plot are that the issues we raise tend to appear as strangely exotic growths to the people in other plots, behind other fences. It seems, then, worthwhile to look for growths that can have roots in the large and common soil we share. That no single person can possibly master the entire field should not prevent us from trying to comprehend it as wholly and as clearly as we can (pp. ix-x).

What is important is that for each of us, as educational researchers, our learning is becoming integrated, even if that learning remains inevitably incomplete.

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