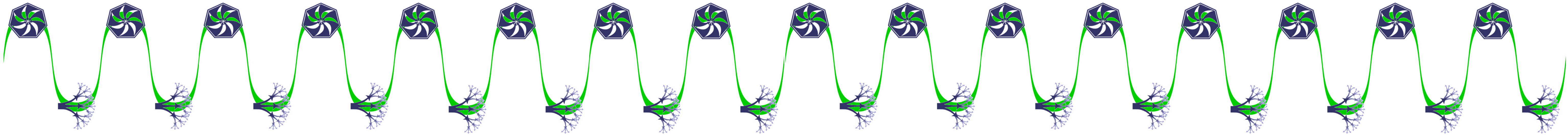
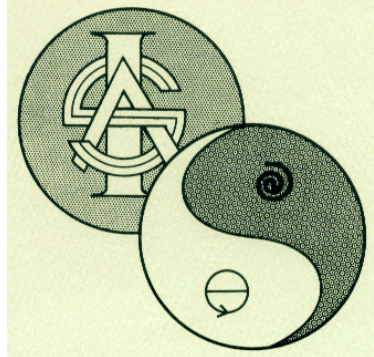


# System's Chaos & Origins: Integration of Sources for the System of Systems Processes (SSP) General Systems Model



## Purpose of This Work

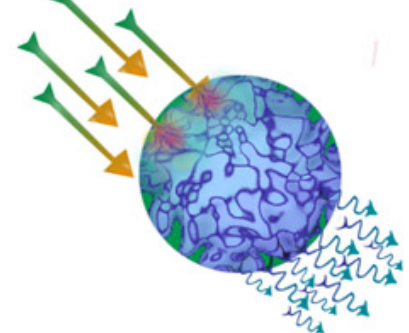
- This poster tries to provide a sample of the many varied sources of information on chaotic processes, and the related system's process of origins. It will provide a glimpse of the growth in workers, literature and institutions that specialize on chaos and origins. It will suggest ways to organize, document, and synthesize information on these key systems processes (isomorphies) and how they interact with some 80 other systems processes in a system of systems processes. The SSP would provide several detailed general theories of systems at different levels of scope, span, and abstraction for application to bettering human and social systems.

## Working Definitions of Chaos & Origins

- Both words are used frequently in common language. How do we discern their system's dimensions apart from their common meanings? A persistent problem.
- For this poster, chaos means attainment of a level of complexity in the parts of a system such that prediction and/or traceable cause & effect is impossible.
- For this poster, origins means the first time emergence of a new scalar level of object in the universe. Emergence and origins are similarly defined at our Institute
- We have grouped chaos and origins together because events of origin of a new scalar level or new stability in nature is often preceded by a period of chaos as shown in the cycles of integration and diversification shown below the title.

## Identifying Features & Functions

- Our research on a systems of systems processes describes each isomorphic process in terms of its special defining features rather than formal math in order to reach a larger professional audience in the natural and social sciences. To this end we use logo's like parables to capture the nature or essence of a systems process like origins. Below are first shown four ID Features that are common to both the related processes of chaos AND origins, followed by a few ID Features for Origins, and then brief citation of five for Chaos.



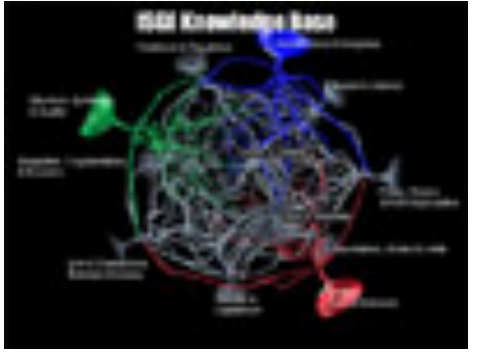
- **Dissipation:** Both chaos and origins are dependent upon an environment which supplies energy &/or materials to the process at the expense of the entities in the environment. They become more disorganized while supplying resources for the new entity as diagrammed at the left.

- **Self-Organization:** The logo to the right represents several independent, separate entities or subsystems restructuring to one new entity, a process so pervasive it is the subject of one of the text collections shown at the far right.

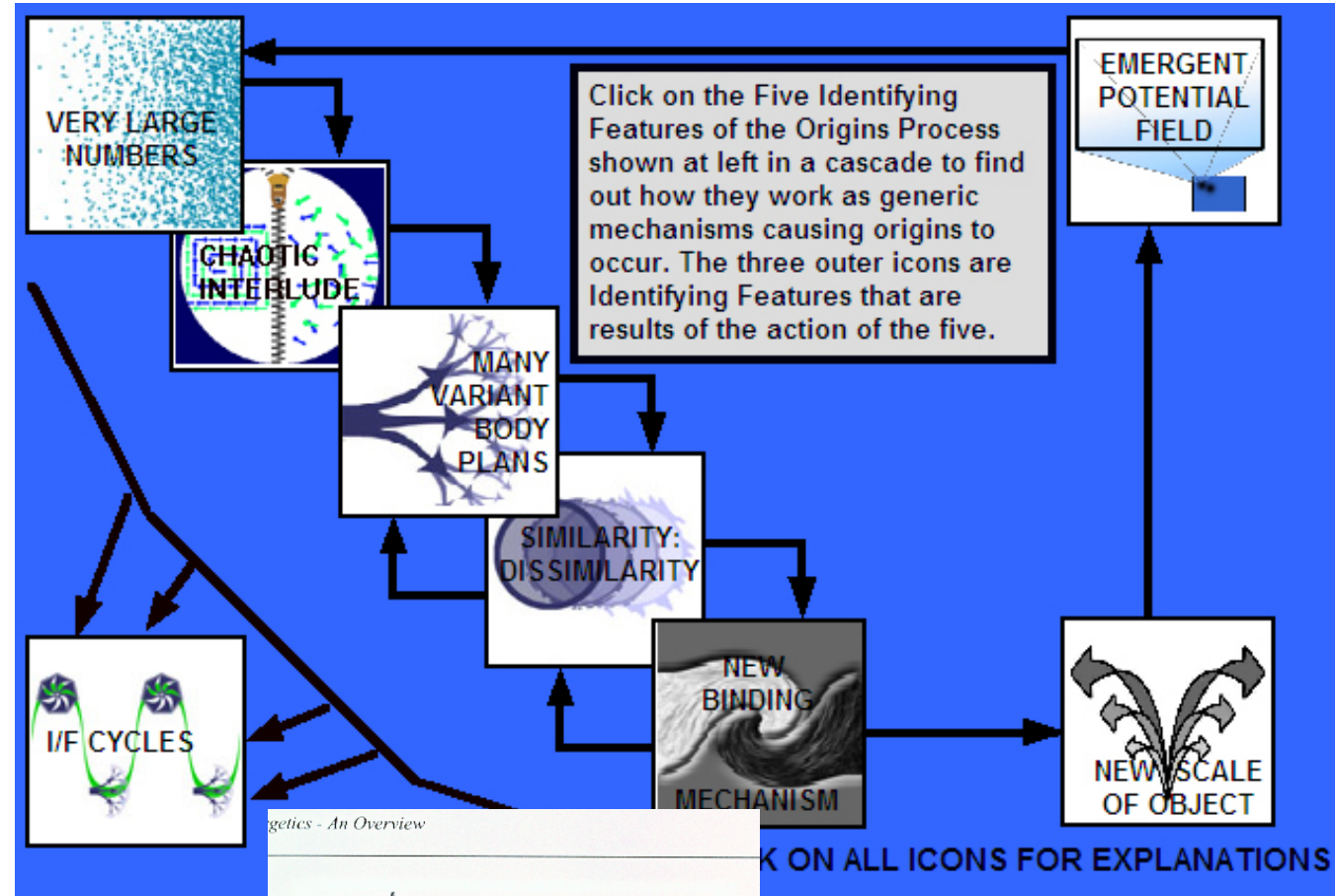
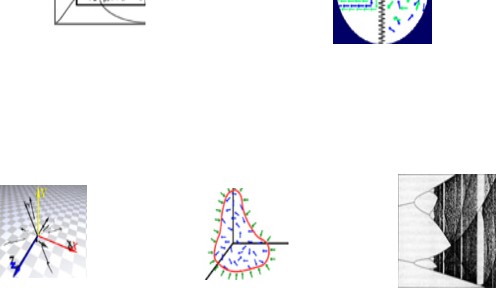


- **Diversity to Complexity:** The new entities on a new emergent scalar level of organization immediately diversify into vast numbers of variants whose interactions are so rich and numerous that what appears to humans as chaos ensues.

- **Nets & Feedbacks:** Networks of interaction spontaneously form resulting in large numbers of alternative feedbacks, pathways, cycles and an equifinality, entitiation, and of possibilities which to humans appear as the complex dynamics we call chaos.



- At the Institute for Advanced Systems Studies at CPP, we have developed a mechanistic theory of emergence (origins) as shown at right which also show logo's associated with the Identifying Features of Origins. Very large numbers of interacting entities at a previous level go thru a chaotic interlude resulting in a vast range of variants that share key parts that are similar and "peripheral" parts that are variable. These associate in different ways until a new body plan emerges using a new master duality for binding and bonding that leads to the new scale of entity starting the process over.



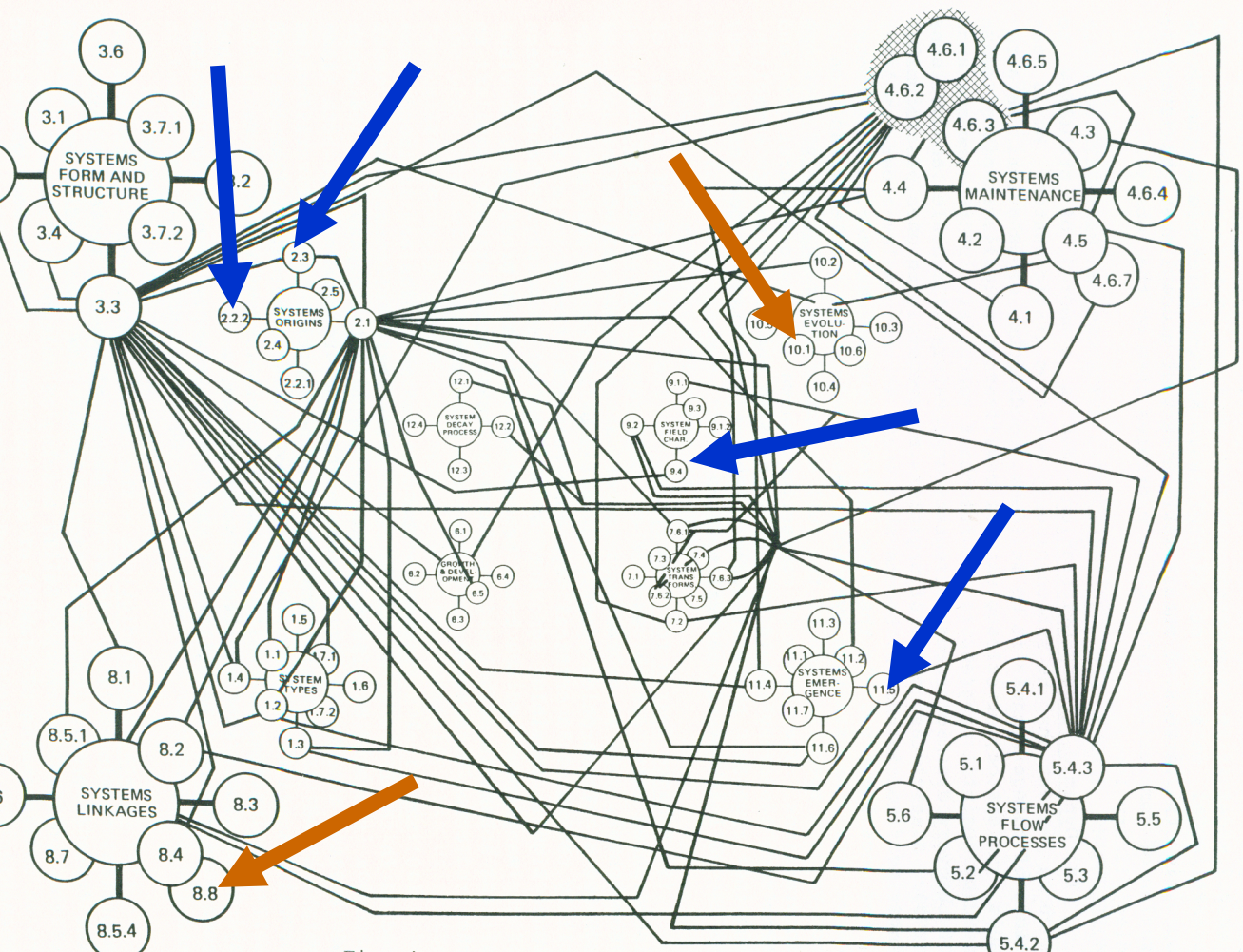
Chaos  
Chaos  
Order  
Order

- Hysteresis logo of chaos turning into order after a lecture by H. Haken

- The surrounding five logo's above and below are some of the Identifying features of Chaos. Clockwise from above left to bottom right are: complex dynamics leading to unpredictable behaviors, tightly coupled order and disorder mechanisms, phase space mappings, attractors, and bifurcations. Our ISGE modules define each and then follow with multiple examples of each in different natural science phenomena.

## Positions of Chaos & Origins in the...

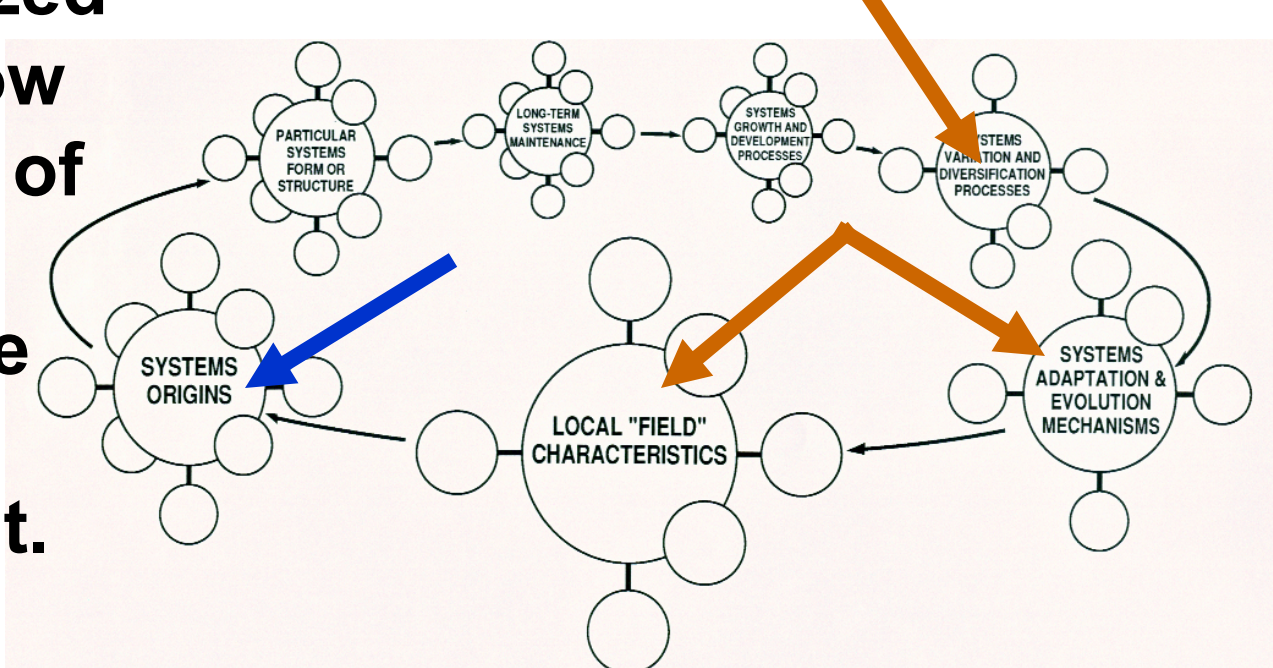
### ...SSP-GST and General Systems Lifecycle



- Graphic representation of the current LP's for only four systems processes on 12 key systems behaviors or phenomena.

- The graphic at the left shows the SSP, a system of system processes, as a set of linkage propositions that describe mutual influences among isomorphic processes common to many systems.
- The node(s) and LP's that represent chaos processes are marked by red arrows and the node(s) and LP's that represent origin mechanisms are marked by blue arrows to show their positions relative to other systems processes and a some of their interactions.

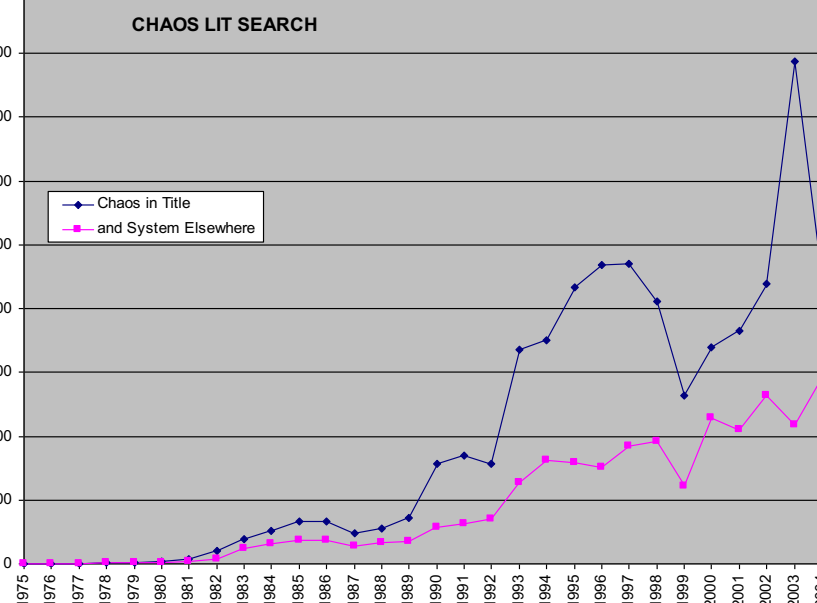
- Graphic representation of the current LP's for only four systems processes on 12 key systems behaviors or phenomena.



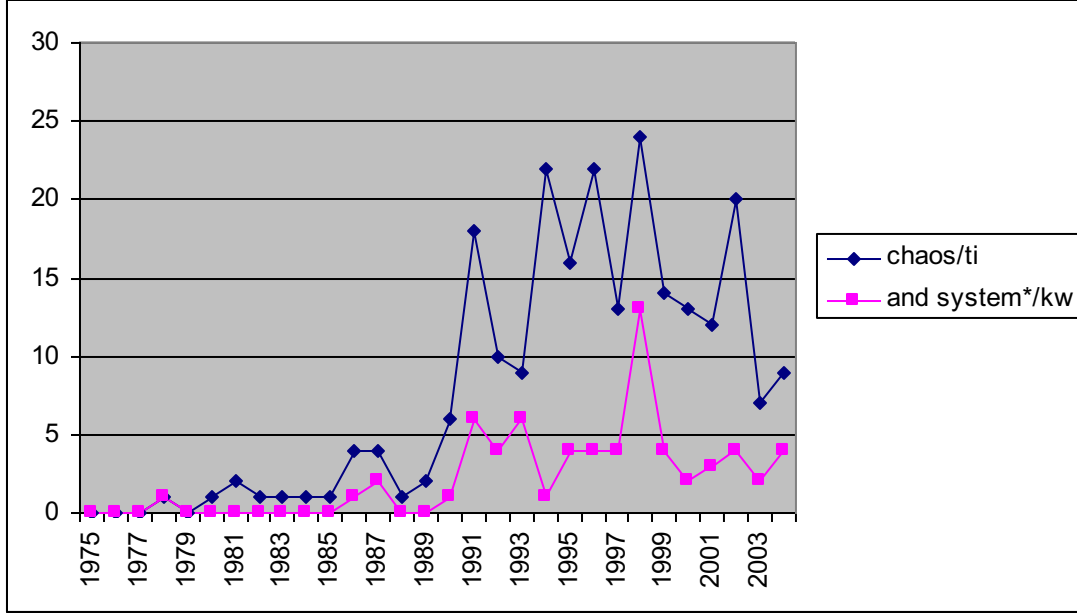
- The graphic at the right shows the proposed General Systems Life Cycle. These are the same 80 processes as shown above, but re-organized in a temporal, sequential flow that models how they act as steps or stages in the maturation of many different types of systems.
- Again the positions of chaos and origins are shown in red and blue respectively to show their role or function in systems development.

## Sources & Scope of Literature: Trends

- The SSP & its GENSYSML tool is based on a massive data survey. Here we try to get a fix on the # and scope of the extensive literature on just one key systems process, that is "chaos" across a broad set of disciplines.....

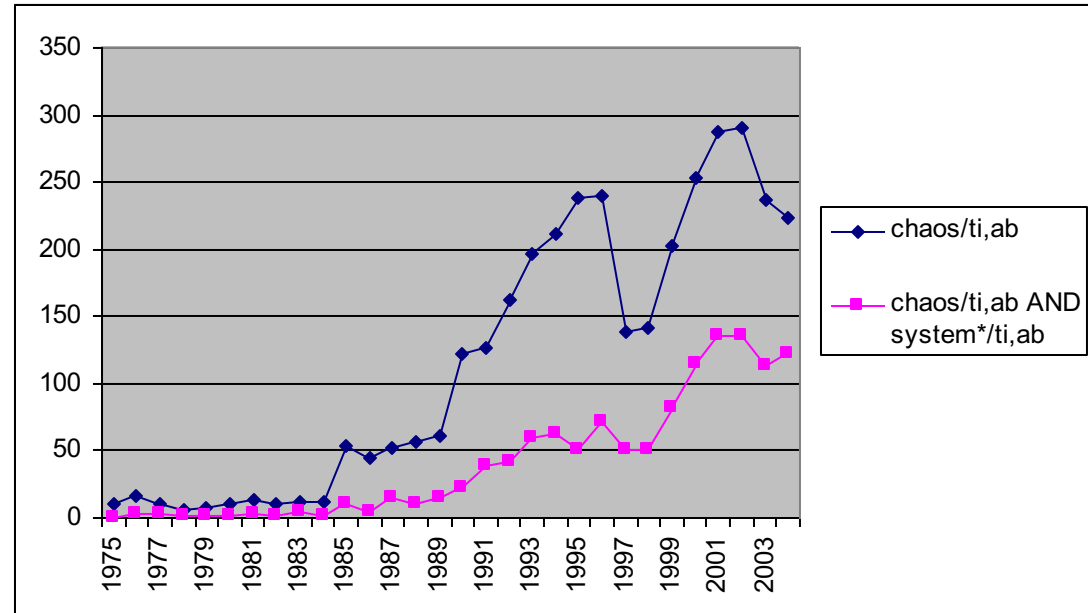


- **THE PHYSICAL SCIENCES:** At right is shown the primary lit hits for all living systems journals. Numbers are intermediate between the physical sciences and the sociological, even though one might argue that origins, evolution, and emergence are primary topics for living systems. Hits from both the word chaos in title and abstract = 3,541. Using "system" in abstract or keyword descriptor gave a more relevant total of 1,278 total hits.

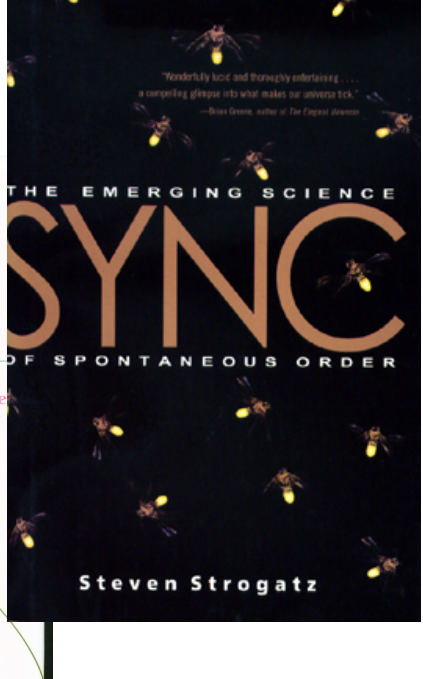
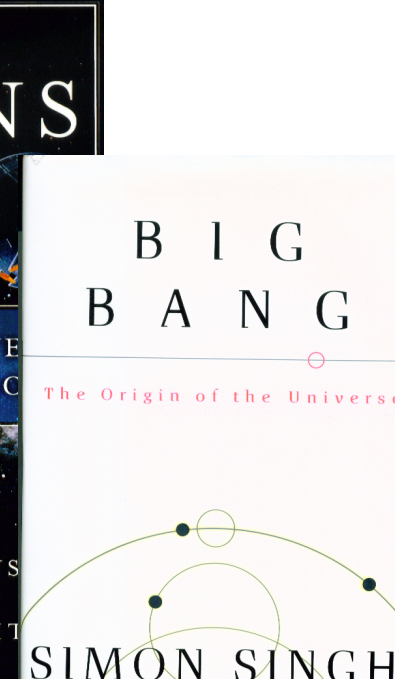
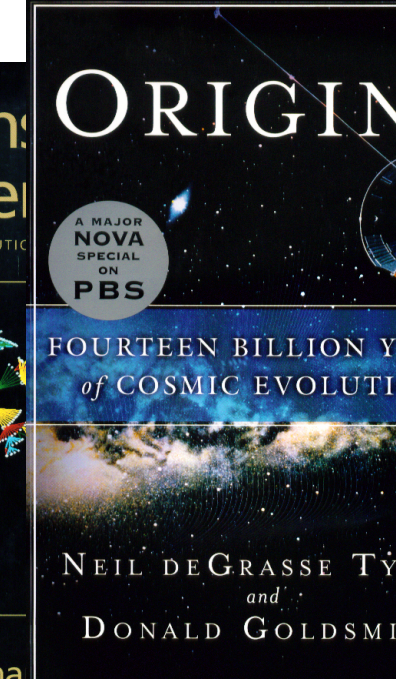
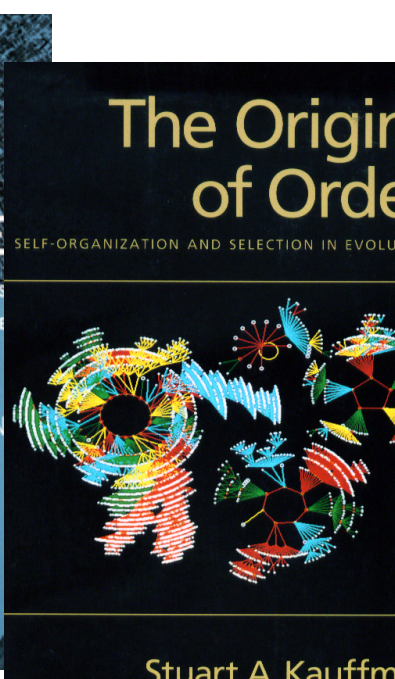
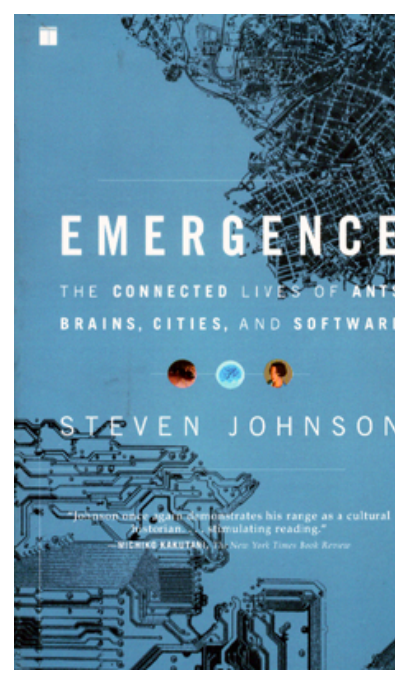
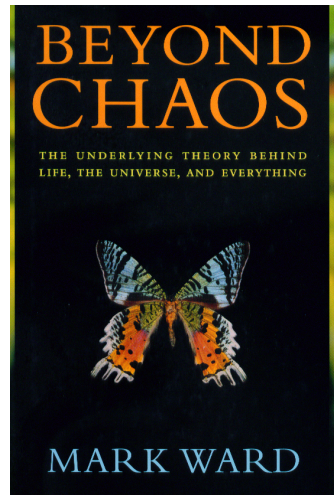
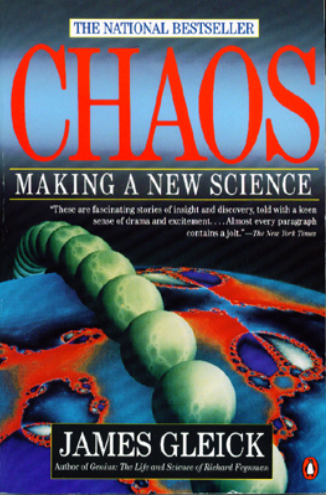


- **THE SOCIAL SCIENCES**

- Just a glance at the total number of hits in this key data base on Sociological Abstracts indicates that despite the existence of professional societies on systems thought in human systems, there is very little penetration of these mechanisms in the sociological primary literature. And when these ideas appear, they generally are only superficially engaged. Total hits in both categories are only 301 for the sample thirty year period.



- **Recent Texts on Origins:** Books are good, dense sources for information bits. Several compendia have appeared on origins and emergence as scientists try to be the first to solve its mystery and popularize their ideas.

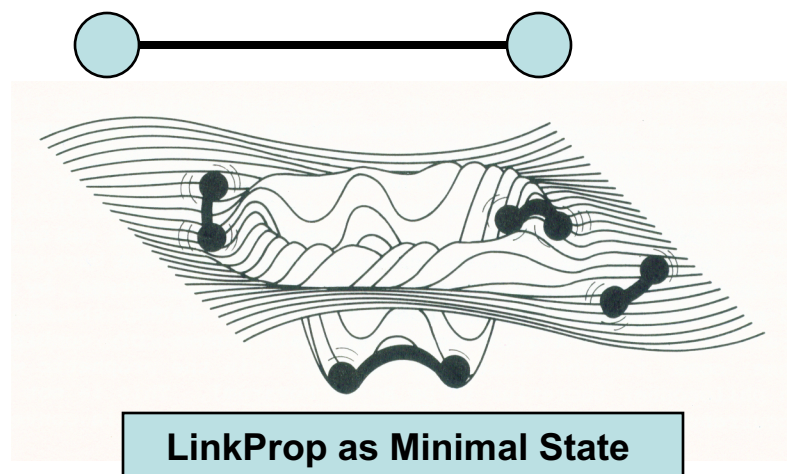


- **Recent Texts on Chaos:** By now a virtual library of books have appeared on chaos and related topics like fractals. It is interesting that the authors often reference cases where this one systems process depends on others without recognizing the utility and necessity of stating them as LP's.

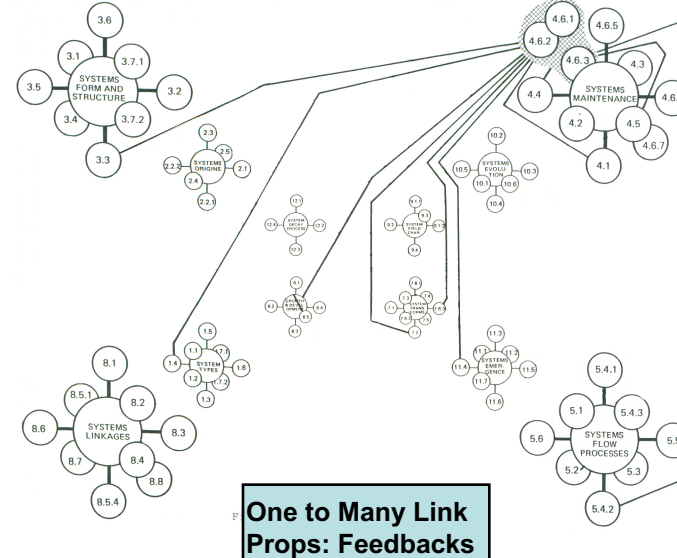
## Sample Information Bits on Chaos & Origins

- One of the problems with the systems literature is words. Words are the friend of explanation, but the enemy of integration. To build a consensus of how systems work, we favor single stand-alone statements of interaction from the literature that can then be investigated by comparison across many different real systems to "test" their span, range, scope, and consistency. They can also then be assembled in different sets for higher explanations of greater detail than presently is the case.
- Examples of information bits for the other systems processes can be found on the student posters in this series. Isolation of these singular observations and findings greatly reduce verbiage in texts.

## Sample Linkage Propositions on Chaos & Origins



- Please see the explanation for Linkage Propositions and their uses in an accompanying poster on the Introduction to the Systems of Systems Processes.
- Linkage Propositions are hypothesized to be as similar isomorphically as the systems processes themselves and also possess the attributes of self-reference, forming networks of complex interactions, axiomatic status. They are the basis for the observation of chaotic dynamics.
- Transgressive equilibrium is a partial cause of origins of new hierarchical levels.
- Transgressive equilibrium is a partial cause of origins of new scalar levels of entities.
- Unsatisfied counterparties (dualities) is a partial cause of new binding strategies.
- Satisfied counterparties (dualities) are a necessary prerequisite for unsatisfied counterparties.
- The neutrality principle (dynamic equilibrium) is a partial cause of successive series of origins.
- Concrescence Ratio is in part the cause of the origin of new systems boundaries
- The Strong emergence that is associated with the occurrence of "gaps" between hierarchical levels is in part the result of counterparties (dualities)
- Mechanisms of Chaos are in part the cause of gaps between hierarchical levels (clusters).



## Key Chaos/Origins Workers/Institutions

- A sample of some of the scientists and institutions who have proven productivity in chaos, origins, emergence, or self-organization research are:
- Stuart Kauffman, Sante Fe Institute, MacArthur Fellow
- Simon Singh, earned his Ph.D. at University of Cambridge
- Ralph Abraham, University of California at Santa Cruz, called the "grandfather" of Chaos Theory
- Steven Strogatz, formerly faculty at Harvard and MIT, now at Cornell University, received Presidential Young Investigator Award
- Harold Markowitz, Yale University
- A series of science reporters have been instrumental in bringing these ideas to the forefront of public opinion. These authors include such names as James Gleick (check out his new book on a biography of Newton), Mark Ward (BBC), and Steven Johnson (out of Columbia University).

## Applications: Chaos & Origins SSP

- The paucity of primary literature in the social science data base might indicate to some that there is great potential for applying the concepts of chaos and origins to the social sciences, economics, and human development.
- In fact, the dynamic systems studies of the stock market has been sponsored in the recent past by corporations donating serious funding to systems theory organizations.
- The question of origins is a major area of study both for the origins of cities, cultures, religions, civilizations, nations, and even the origins of humans themselves as a species. However, it is not clear how effective or robust the application of findings in the theory of chaos and complexity has been to improving our understanding of these major human phenomena.