Complex Systems

By Jack Lillibridge

The theory of complex adaptive systems identifies component processes that undergird these two aspects of nature, such as positive and negative feedback. A notable instance of a complex adaptive system is a living organism, which includes elements of interaction with the environment and of memory.

This view of nature is characterized by two interrelated aspects. One is characterized by equilibrium, balance, continuity, renewal, etc., resulting in maintaining the existing order. I call this first aspect stability. Nature is also characterized by creativity, learning, exploration, risking, etc., resulting in a new, more complex, order. I call this second aspect growth. These aspects are both complementary and mutually interacting, relating to a dynamic ongoing overall process.

There is a dynamic process described as part of the theory that perhaps will contribute to an understanding of the current economic crisis, especially how it could occur as it did. This dynamic process is the time course from a persisting, stable order, through a transition or threshold, to a new, persisting stable order that is more complex. There are at least three things to understand: what could cause a transition, how could the transition occur, and what might the new order look like. For instance, what triggered the transition and what will influence the kind of new order that results?

A metaphor frequently mentioned in writing about this area is the “edge of chaos”. Complex systems are seen as being far from equilibrium and poised in a state of order just short of being in a state of chaos. In this position, the complex system is very sensitive to environmental changes and can react very quickly to create a new order that better copes with the changes. The edge of chaos position is like being a diver at the end of the diving board, at the instant of choosing to leap.

In system terms, this is a kind of threshold that the system reaches and manages to pass through. Something that “nudges” the system at the instant of choice is a random element (internal to the system or from the environment) that triggers passing through the threshold. It is impossible to predict what the particular random element will be. [Editor’s note; the link to Maury’s notes on three books is as follows:- staff to insert link.]Because the complex system is nonlinear, it is also impossible to predict the specific new order that will ensue. It is sometimes possible to project the set of new configurations of system elements, but not the specific choice within that set.

Complex adaptive system theory is believed to incorporate universal principles, applicable to every discipline or science including economics. [Editor’s note; the link to John Khosh’s essay, “Consilience: A Biological Example” is as follows:” staff to insert link.] At the least, it should be a rich source of ideas by analogy about the process of

economic decision-making. The variables that enter into the theory are system-wide emergent properties, not properties of individual system parts or sub-systems.

For instance, the theory would suggest that the "normal" state of the economic system is being far from equilibrium, poised at a threshold of changing its organization. This reorganization could occur through rearranging the system parts and/or by bringing in matter or energy from the system's environment. What looks like equilibrium is actually believed to be a dynamic stability that could very quickly change to an unpredictable new stability.

As a system approaches the threshold, the existing order gets progressively less able to contain or deal with the frequency and intensity of the changes that are occurring. A new order is needed.

The traditional economic model postulates that the economic actor is fully rational, in possession of complete relevant information. In the aggregate, these actors have a known set of preferences. Given the same information and preferences, they will make the same rational decision. There are at least two problems with this model. The actors do not have complete information and their preferences can change. The model assumes that any psychological or individual difference factors will wash out in the aggregate, negative factors balancing positive factors, so they can be ignored.

Psychological factors affect the quality and completeness of the actor's information. For instance, emotions and motivations steer the person's attention to some information and away from other information, filtering what information is perceived and sought. For instance, people believe or predict that current trends will continue and do not look to see or test whether anything has changed that will impact the trend. That is, they do not register all of the available information.

I believe that the emotion of trust is central to the dynamics of the economic system. At some point, a critical mass of economic actors realized that the information that they were relying on was faulty and insufficient and that the economic model was not working. For instance, they could no longer predict what was going to happen in the market or the real value of assets.

This realization by economic actors led to a severe widespread loss of trust resulting in inaction and pulling back. The existing order was not able to handle the current situation impelling a transition. A random element, such as a government action, was the trigger.

One view is that the new economic order and new paradigm has arrived and is in the process of being recognized for what it is. Another view is that the transition is still occurring and the current field of forces and resources will affect the order that stabilizes.

If the view that we are presently figuring out that what is happening is the new order, then the level of trust will affect whether stabilization or a more intense crisis will occur.

If the continuing transition view is a better representation of reality, then the steps taken now to deal with the crisis will affect the resulting order.

If the new order fosters or perhaps stops inhibiting the increase of productivity and innovation, we should come out of the current crisis in a better place.

Jack Lillibridge, April 11, 2009

Jack Lillibridge has a Ph.D. in Psychology from Case-Western Reserve University, with postdoctoral work at the University of Michigan and Cornell University. He was an Assistant Professor of Management at the School of Business of the State University of New York in Albany, (1970-1975), where he taught behavioral science to business students. Then he was an Assistant Professor of at the Graduate School of Business Administration, University of Michigan (1966-1967). Most of his career was as an Associate Psychologist for the New York State Office of Mental Retardation and Developmental Disabilities. He retired in 1996 and has done some volunteering since that time helping intellectually challenged adults. He is a member of ASPEC (Academy of Senior Professionals at Eckerd College) and an active participant in the Seminar on Improving Strategic Decisions.