HUMAN SYSTEMS
DYNAMICS INSTITUTE

Circle of Sciences

Influences that continue to shape the field of theory and practice

Autopoiesis
(http://www.oikos.org/mttiario.htm)

- Maturana & Varela

Autopoiesis comes from Greek "self-made." Maturana and Varela see this as the primary distinction between living and non-living things. From their concept of self-organizing systems emerges an understanding of enactive cognition. In HSD we use these ideas to talk about self-organizing and, in particular, the significance of the container in influencing self-organizing dynamics.

Catastrophe Theory
(http://home.swipnet.se/~w48087/faglar/materialmapp/teorimapp/ekt1.html)

- Rene Thom

Discontinuous change is represented mathematically by characteristic manifolds in space/time. As the number of relevant dimensions increases, the descriptive shapes become increasingly difficult to represent physically. In HSD we use Catastrophe Theory to consider dynamics of high dimension systems. Though movement in high dimension space can be patterned and recognizable, it cannot be predicted moment to moment, and the patterns cannot be described easily with a two- or three-dimensional model.

Cellular Automata
(http://mathworld.wolfram.com/ElementaryCellularAutomaton.html)

- Stephen Wolfram

A cellular automaton is a very simple computer simulation that can generate complex and unpredictable patterns. It is one example of simple rules driving local behavior that generates systemic patterns. The cellular automaton is the simplest and most studied example of simple rules in action. In HSD we use the simple behavior of rule-based simulation models to think about the complex behavior of human systems.

Complex Adaptive System
(http://en.wikipedia.org/wiki/Complex_adaptive_system)

- John Holland

Collection of agents free to act in unpredictable ways, and their interactions generate system-wide patterns. Sometimes called self-organizing systems. The CDE Conditions for Self-Organizing were initially drawn from this field and confirmed in others.

Deterministic Chaos Theory
(http://en.wikipedia.org/wiki/Chaos_theory)

- Edward Norton Lorenz

Even simple and deterministic initial conditions can, under certain circumstances and in certain relationships, generate behavior that is unpredictable. Strange attractor patterns and butterfly effects come from this discipline. In HSD we often refer to uncertainty that emerges, even when initial conditions are well known.

Dissipative Structures
(http://en.wikipedia.org/wiki/Dissipative_system)

- Ilya Prigogine

Counter to Newtonian assumption that order always tends to disorder, order can sometimes arise "spontaneously." In a branch of thermodynamics, a system pushed far from equilibrium reorganizes itself and dissipates accumulated entropy (disorder). The emergent patterns in complex systems that we discuss in HSD function as dissipative structures, for example innovation, teaming, trust, crowd behavior, and employee engagement.

Dynamical Networks
(http://en.wikipedia.org/wiki/Dissipative_system)

- Albert-Laszlo Barabasi

Traditional networks include nodes and connections. Dynamical network theory considers how dependencies within and between networks can shift the nature, structure, and function of networks in a self-organizing way. HSD uses dynamical networks to inform our own management and organization decision making and to support clients in designing and implementing organizational change.

Emergent Evolution
(http://stephenjaygould.org/)

- Stephen Jay Gould

Evolution can be seen as burst of creative process between periods of minimal change. Gould described this process as punctuated evolution and explored how complex, nonlinear dynamics were at work to set conditions for such a discontinuous process. In HSD we consider a similar phenomenon when we talk about dynamical change.

Fractals
(http://www.coolmath.com/fractals/gallery.htm)

- Benoit Mandelbrot

When simple, nonlinear equations are solved repeatedly and the stability of the results plotted on a complex number plane, patterns are generated that are 1) self-similar across scales; 2) complicated but coherent; 3) never repeating; 4) really, really beautiful. In HSD we use the idea of iterative processes to generate coherent and quite diverse structures in human systems.

nK Landscapes
(http://en.wikipedia.org/wiki/NK_model)

- Stuart Kauffman

Computer simulation model of network where the number of nodes and connections among them determine the stability and variability of the space. Used to model fitness and evolution of biological agents under various conditions. Sometimes they are called fitness landscapes, and the various states can be seen as parallel to the zones of the HSD Landscape Diagram.

Self-Organized Criticality
(http://en.wikipedia.org/wiki/Self-organized_criticality)

- Per Bak

Studying sandpiles, Per Bak identified a mathematical relationship among the numbers, sizes, and frequencies of avalanche events. This relationship is a constant across discontinuous changes in many kinds of systems—both living and nonliving. He explained the phenomenon in terms of accumulating and releasing tension within or beyond a particular system boundary. This principle sets the groundwork for the HSD paradigm shift of dynamical change.

Synergetics
(http://en.wikipedia.org/wiki/Synergetics_(Fuller))

- Buckminster Fuller

Coherent patterns emerge at a systemic level from complex interactions of constituent systems. This study was used in early research and design for laser technologies. Relationships among the parts that influence emergent patterns are called order parameters. Influence of the pattern on the parts of the system are called control parameters. The self-organizing image in HSD is related to these dynamics.

Systems Dynamics
(http://www.systemdynamics.org/what_is_system_dynamics.html)

- Jay Forrester

System interdependencies modeled as a combination of stocks and flows, showing an accumulation of some relevant variable and the influence of variables on each other. Models can be qualitative and used to explore the underlying logic in a system or they can be represented in computer simulation models. From an HSD perspective, systems dynamics models are good representations of known differences and exchanges within a given container.