



HUMAN SYSTEMS
DYNAMICS INSTITUTE

Human Systems Dynamics

Glossary

This glossary offers the most current thinking about how these terms and ideas are used in the field of HSD. Thanks to Glenda Eoyang and other HSD Associates who continue to clarify and articulate the language that goes beyond description to help *explain* how humans live, work, and play together. Many of these concepts are further explained and defined on www.hsdinstitute.org. If there are words you believe should be added, please contact us at <http://info@hsdinstitute.org>.

A

Adaptability is the ability of an agent (individual, group, organization, etc.) to respond to change, opportunities, and challenges in the environment.

Adaptation is the alteration of a system as it responds to change, opportunities, or challenges internally or in the greater environment.

Adaptive Action is an iterative decision-making and problem-solving process that addresses underlying dynamics of a system. As described by Eoyang and Holladay, it includes three steps:

- ▶ **What?** describes the current situation's patterns.
- ▶ **So what?** allows agents to make meaning by exploring the patterns and their implications for the system to identify and select possible options for informed, wise action.
- ▶ **Now what?** moves the system into action, selecting and carrying out activities identified in the **So what?** step. After taking action the agent stops to reassess the impact the action, moving back into the next **What?** step with new information and observations.

Adaptive capacity is the ability for an agent (individual, group, organization, etc.) to engage in Adaptive Action over time and in unknown and unpredictable situations to see, understand, and influence patterns in the system.

Agents are the semi-autonomous "actors" of a system. They interact in unpredictable ways to create system-wide patterns through a process of self-organizing.

Nothing is intractable.

Attractor pattern is a particular “trail” or recognizable pattern of change, created across time. Four types of attractor patterns contribute to our understanding of adaptive capacity.

- ▶ **Point attractor patterns** appear to converge toward one spot. Examples include traffic patterns that converge around the speed limit; children planning for their first day of school, and patterns of listening to and purchasing a particular musician’s work. You can encourage point attractor patterns to increase the coherence in a system or to focus your system’s energy on one event or outcome.
- ▶ **Periodic attractor patterns** occur in repeating cycles. Examples include activities around planning for seasonal products, behaviors and rituals related to payday and budget development, and regular attendance in a faith community. In human systems you can encourage periodic attractor patterns to increase predictability, agreement, and certainty, pulling people to greater coherence and stability.
- ▶ **Strange attractor patterns** emerge when there is a boundary that provides unlimited possibilities within. One example is the variability in particular relationships. Everyone has a general idea of what it is to be a mentor, but every mentor/mentee pair shares a unique relationship. The general definition is the boundary, with the multiple realities providing the unlimited possible patterns within. You can encourage strange attractor patterns to allow for and benefit from the variation and diversity inside a system or set boundary.
- ▶ **Random attractor patterns** describe systems where no pattern of change can be discerned currently. Examples include the time immediately after a disaster or a new cultural or learning experience. These attractor patterns offer freedom to explore new possibilities.

B

Bifurcation is a split in the system that occurs when the tension from differences become so profound that the container cannot hold them, and the exchanges are no longer sufficient to sustain flow of information and resources for system fitness. Under those conditions, the differences split the system into separate containers.

Boundaries (referred to by Eoyang, et.al. as “containers”) are the regions of contact between different parts of a system. They can be formed by multiple conditions, including physical conditions (walls, distance); conceptual conditions (affiliation, love); geographic conditions (geographic borders, mountain ranges); or cultural conditions (traditions, ethnicity).

Butterfly effect is the phenomenon also known as “sensitivity to initial conditions.” Observations in nature have shown that, under some conditions, small actions in one part of the system can trigger large responses in another part of the system. While you cannot know what will trigger a response, you can use Adaptive Action to respond productively to butterfly effects. The steps of Adaptive Action help you see, understand, and influence patterns and to make continuous small adaptations to take greatest advantage of the sensitivity in the system.

C

Three Kinds of Change shape the variety of movement and action in a system, as defined by Eoyang and Holladay. Understanding each kind informs wise action.

- ▶ **Static change** is the simplest type of change. It depends on direction and force. It is predictable. Static change is about moving from Point A to Point B by applying force or external motivation/incentive. Only the starting and ending points of a process or effort are considered, with little or no attention to how those outcomes are achieved. *Incentives, rewards, or punishment provide the motivation for change in behavior or performance.*
- ▶ **Dynamic change** is more complicated, depending on direction, force, and time. When change is dynamic, it moves along a smooth trajectory toward a predictable end point. Like water shooting out of a hose, if pressure and angle are known, you can predict height and distance of the arc of water. *Dynamic change occurs according to developmental stages that can be described, tracked, and predicted, and externally-derived standards and benchmarks serve as measures of change.*
- ▶ **Dynamical change** results from multiple forces acting in unpredictable ways, generating surprising outcomes. It is emergent, unknown, and uncontrollable. While you can neither predict nor control how change will happen, you can set conditions that will be more likely to shape the emergent change. Adaptive Action is required to influence dynamical change. *Consider water dripping from a faucet. The rate of drops depends on too many factors to predict, precisely, when each drop will fall. The amount of deposit in the pipes; the temperature, wind, and humidity in the room; and the amount of water in the pipe interact in unpredictable ways to determine when drops will fall.*

In complex systems, we often choose one kind as the focus to be able to make sense of our experience, even knowing that in doing so, we may lose sight of valuable data. *When we consider skill development as static change, we can only know whether or not skill was developed. When we consider skill development as dynamic change, we can consider if the skill developed according to expected growth rates, level of expertise, etc. When we consider skill development as dynamical change, we can use multiple perspectives to understand and influence the rate, degree, needs of development.*

Nothing is intractable.

Coevolution occurs when growth and development in one part of the system triggers similar changes in another part of the system. It is the result of the interdependent and massively entangled nature of the system itself.

Coherence is the degree of fitness (see Fitness) among parts of the system. Parts work together in logical and consistent ways to build a sustainable whole that finds fitness with the environment. Eoyang has identified seven characteristics of coherent systems.

- ▶ Shared goals shape the work of individual agents toward system fitness.
- ▶ Shared meaning contributes to coherent thought and action as patterns play themselves out across the landscape.
- ▶ Repeated patterns increase familiarity and productive redundancy in the system.
- ▶ Adaptation to internal and external changes enables the system to engage successfully in challenges and access opportunities to move toward greater fitness.
- ▶ Reduced internal tension requires less internal management of difference and results from the complementary nature of parts and processes in the system.
- ▶ Complementary functions ensure that all parts of the system carry out unique and interdependent roles to contribute to its fitness.
- ▶ Conserved energy means that the energy of the system is used to find greatest fitness in the environment rather than to resolve intolerable internal tension.
- ▶ Complex adaptive systems are made up of individual agents that interact in interdependent ways such that they create system-wide patterns. Those patterns subsequently influence the behaviors of the agents. Eoyang describes the degree of complexity in a CAS, as determined by the interaction of three system-wide conditions (see Conditions for Self-Organization, below).

Complex Adaptive System is defined by Kevin Dooley as a group of interdependent agents that interact in unpredictable ways, such that they form system-wide patterns. Those patterns, in turn, influence the subsequent behavior of the agents in the system. *In HSD, we use this to understand a number of phenomena, such as the emergence of patterns of culture in a community; the emergence of new thought patterns in learning; and the emergent patterns of group behavior, such as traffic patterns, mob formation, and family dynamics.*

Conditions for Self-Organization are the internal constraints that shape the speed, path, and direction of self-organization. Identified by Eoyang in her doctoral research, system constraints emerge to influence patterns by setting conditions of similarity, difference, and connection. Eoyang created a model that describes and explains those conditions. It is the CDE.

- ▶ **The Container (C)** bounds (see the definition of Boundary, above) the system until patterns can begin to form. They exist at multiple scales, in varied configurations, and are massively entangled with each other. *Containers can be concrete realities in the system, such as the physical location or space. They can also be concepts and ideas that draw people together. Meeting agendas, for example, create a boundary that shapes the patterns of flow and productivity in the meeting. They can be affinities that draw people together, such as friendships or shared interests.*
- ▶ **Difference (D)** in the system allows for change as agents negotiate and accommodate diversities that separate them. While a highly diverse system usually has too many differences to count, the important shifts will happen around those differences that are most critical to the system's overall fitness. *Differences in a system may be expressed as difference in kind or degree. Leadership skill is different from accounting skill (kind of difference). One person may have more years of leadership experience than another person (degree).*
- ▶ **Exchanges (E)** allow agents in a system to connect across differences. Exchange is the flow of information and other resources across the system. *Flow can be facilitated through human interaction; through the rules and regulations that inform decisions; or through shifting of resources such as money, goods, and time that represent value in a system.*

Conflict Circles is an HSD model/method that helps to untangle complex stories and diverse perspectives in difficult situations. As individuals focus on differences that make a difference to them, they clarify their own perspectives, and ask questions of others to come to shared understanding about the conflict they face. This is based on a model that was originated by the Landmark Forum.

Constraints are limitations or restrictions that emerge from within a system. This is about the degree to which expectations, policies, processes, interactions, and connections inside the system influence agents' interactions and responses, creating tension in the system. Through the process of self-organization, constraints emerge in a system and dissipate the "chaos" and uncertainty that exists. As they emerge, constraints shape the path of self-organization and the emergence of patterns across the system. Constraints influence emerging patterns by shifting the speed, path, and direction of self-organization.

Collaborative Adaptive Action Networks (CAANs) are networks of individuals or organizations that come together to accomplish a task. When their work together is accomplished, the network dissolves its working relationships as the agents are drawn to other work. CAANs are the 21st century form of committees, providing greater adaptability and fluid response as the system encounters and responds to the many forces that shape the internal and external landscapes.

D

Decision Map represents three factors at play in individual and organizational decision making. According to Eoyang, Yellowthunder, and Ward, three factors influence decisions in complex and nonlinear ways:

- ▶ World View emerges as a result of the influences of background, education, and experiences that shape perspectives brought into the decision-making process.
- ▶ Rules are the parameters and expectations that shape the decision making. They may be formal and published; they may be informal, like community norms; and they can be either conscious or unconscious.
- ▶ Reality is the tangible evidence or information that presents itself in the environment of the decision making.

E

Emergence is the manifestation of new patterns and constraints as a system goes through the process of self-organization.

F

Feedback loop is an exchange that provides a path for sharing information, material, or energy between a system and its environment or internally between and among the agents that make up the system. *In human systems we often form feedback loops to share performance information, track overall health of a system, and to gauge the system's relationship in its landscape.*

Finite and Infinite Games provide a metaphor of how systems interact and behave along a continuum of constraint. The idea was introduced by James Carse in his book, *Finite and Infinite Games: A Vision of Life as Possibility and Play*. In HSD we operationalize his concepts in terms of the conditions for self-organizing

- ▶ Finite games are interactions that are highly constrained by agreed-upon rules, the designation of winners and losers, a known field of play, judges and referees, and players and observers. Human systems engage in finite games when they compete or attend only to what is local and what is current. Players rely on assigned privilege, based on strength, skill, and control. The purpose of a finite game is to win.
- ▶ Infinite games, on the other hand, are much less constrained. The rules may be clear, but they are not permanent; time is not limited; everyone plays on an ever-changing field; and the purpose of the game is to keep playing. When players perceive the end of the game is near, they change the rules to continue

playing. They rely on trust, courage, and adaptability, as opposed to individual privilege, to participate in their infinite games.

Fit/Fitness means literally, "to be in harmony with or to match." All change in a complex system is due to adaptation of the system as it responds to tensions that limit fitness in its current environment.

Four truths is a way of explaining different perspectives and how they come to be. The concept is based on the work of Jurgen Habermas and his ontological realms.

- ▶ **Objective truth** exists when reasonable people know something to be true, based on evidence they can perceive. *Evaluative data and measurement are examples of objective truth.*
- ▶ **Normative truth** exists when a group of reasonable people agree that something is true, even if they have no objective data. *Social norms are examples of normative truth.*
- ▶ **Subjective truth** exists only for an individual, based on his/her own experiences or biases. When subjective truths are intentionally shared across a group of individuals, they become normative truths. *Beliefs and tenets of personal faith and feelings are examples of subjective truth.*
- ▶ **Complex truth** recognizes all the other truths as equally valid and opens the possibility to focus on whichever of the truths is more useful.

Fractal is the name given to images that are generated by nonlinear equations or phenomena, where each part has the same shape or pattern as the whole. Examples include natural shapes like the branching of a tree or the self-similar nature of snowflakes--all are similar in shape, but differ in the particular parts. You can use this idea to understand how patterns of behavior and thought show up at various levels in an organization, community, or family. *The degree of openness and hard work of leadership, sets a pattern for how those characteristics show up in the rest of the system. Healthy, resilient relationships of adults in a system will influence the children's abilities to create those relationships.*

G

Generative engagement is the name given to an HSD-based model that represents one way CDE can shape patterns in the system. In their work, Nations and Holladay suggest the following conditions for creating patterns of generative engagement.

- ▶ The container is a shared identity where we see the world together, without either of us losing our own, personal identity.
- ▶ The difference that matters most is the perceived power. In generative

engagements power is influence, and you allow others' power to influence you, even as you carefully consider your influence on others.

- ▶ The exchanges in generative engagement are shaped to grant voice to others and to generate voice so that others can hear and understand you.

These conditions have the potential to shape generative patterns:

- ▶ Where identity and power overlap, the emergent patterns contribute to reciprocity.
- ▶ Where identity and voice overlap, the emergent patterns contribute to authenticity.
- ▶ Where power and voice overlap, the emergent patterns contribute to justice.

H

Human systems dynamics (HSD) is an emerging field of research and practice that applies principles of complexity, nonlinear dynamics, and chaos theory to the study of individuals and groups of humans as they live and work in teams, organizations, and communities. As people come together to work or play, to plan, or to make decisions, each brings myriad experiences, knowledge, and needs. These complicated and free individual and institutional agents interact with each other, resulting in patterns of behavior that emerge from the diversity of the collection. Human systems dynamics is the study of those emergent patterns and what they can teach about productive possibilities for action in human systems at all scales.

I

Innovation is the emergence of a unique, fit-to-function response when a complex system faces a challenge or opportunity. In HSD we see innovation as the function of adaptive capacity that enables a system to respond in resilient and responsive ways.

Interdependent Pairs is an approach that reflects the complex and interdependent nature of seemingly incompatible patterns in a system. The patterns, however, are linked in dynamical ways that can inform decision making. Leaders can use the idea of interdependent pairs to inform their choices as they address their sticky issues. *An example explores the connections between and among the manufacturing concepts of speed, quality, and cost. You may have to sacrifice speed if you want high quality. Quality of production depends on cost and speed. Working faster may require greater resources, increasing cost.*

Inquiry is the practice of seeking what is both true and useful. HSD defines inquiry as the ability and will to:

- ▶ Turn judgment into curiosity
- ▶ Turn disagreement into shared exploration
- ▶ Turn defensiveness into self-reflection
- ▶ Turn assumptions into questions

L

Landscape Diagram is an HSD-based model that allows you to visualize or map the constraints in a system. The map is represented by two axes. The X-axis represents the degree of certainty (ability to predict the future). The Y-axis represents the degree of agreement (shared expectations, perspectives, or knowledge among a relevant group). You can use this model and method to explore current system constraints that hold you in a particular situation, and take informed action to move toward greater fitness. *The model used in HSD is modified from the work of Zimmerman, Lindberg, and Plsek, who built their work on the original model proposed by Ralph Stacy.*

Learning Ecology is the interconnected system of supports and resources used in training and development opportunities to set conditions for teaching and learning. It consists of the structures, expectations, and assumptions that frame teaching and learning. *In the HSD Professional certification course, for example, the Learning Ecology consists of the materials, conversation, and interactions, and venues, both in person and online, that manifest the 4-month learning experience.*

The key consideration for an ecology that supports deep learning is that it creates a system of teaching/learning that invites learners to engage in whatever way is most fit for them. It is the environment, rather than the sequence of activities, that sets the conditions for teaching and learning that builds skill, ability, and deep understanding of the patterns and conditions that shape one's experience.

Learning Triangle is a model/method that represents the interplay between theory and practice that generates individual or group praxis. As you learn new theory, you test it in action to improve performance or to expand the theory. As you learn from your experience of using the theory, you may amend or enhance what you know in support of the theory. That is the essence of praxis—learning from doing and doing to learn.

M

Midlevel abstraction is a class of models or methods that represents the interrelationships among the conditions that shape the speed, path, and direction of self-organization in a complex system. In HSD we use mid-level abstractions to reflect special case applications of the CDE model to help people visualize particular patterns to better understand the dynamics of their systems and support their Adaptive Action.

Models and Methods are the graphical representations that help us understand and take informed action in our complex systems. As a model, an image represents the reality of the relationships between the container, differences, and exchanges in a system. As a method, that same image can represent how we can shift the conditions to change the emergent pattern.

N

Networks are groups of interrelated agents that make up a system. In human systems this can be people who come together over a shared interest or common need or concern, and can also include the ideas, communication media and methods, and other connections that hold that group together. A network is made up of nodes, which represent any agent in the network. The nodes are linked by connections. Nodes that have more connections than others are called hubs because they facilitate larger percentages of the flow of information and resources across the system. There are four common types of networks, characterized by the distribution of the density of the nodes.

- ▶ **Scale-Free networks** are networks where there are a few high-density nodes, a larger number of medium-density nodes, and many low-density nodes. Power, information, and other resources are distributed across the network; and each node contributes to system fitness. These are robust networks, but unpredictable.
- ▶ **Small World networks** are made up of individual nodes where the information and power is clustered, and connected to other nodes locally. Some hubs in these networks have global connections. This means that, from any node in the network, you can be connected globally within two or three steps. This is a highly efficient structure whose behavior and performance may or may not be predictable, depending on the makeup of the network.
- ▶ **Hub-and-Spoke networks** concentrate power into very busy hubs that are connected to their own group of nodes. In these configurations, the hubs often become overloaded and exhausted. This makes the overall structure relatively fragile because of the total dependence on the hub to serve its own

group of nodes. If that hub goes out, all the nodes in that hub are disconnected from the whole. At the same time, when the hubs are working, these are highly predictable networks.

- ▶ **Random networks** distribute information and power across all nodes, leading to confusion and redundancy. It is a costly network structure that is ultimately unpredictable and inefficient. They are useful, however, in that they can be built quickly for particular needs.

P

Pattern is made up of similarities, differences, and connections that have meaning across space and time. They emerge as a process of self-organization occurs in the system.

Pattern Logic is the use and study of disciplined reasoning based on the conditions for self-organizing (Eoyang CDE). The effective use of Pattern Logic builds adaptive capacity to respond to unpredictable change in complex environments.

Praxis is an activity that depends equally on theoretical knowing and practice. We engage in praxis as we take the HSD theory and apply it in Adaptive Action to see, understand, and influence patterns in our complex systems.

R

Radical Inquiry is a process of self-reflection done by individuals or groups to identify and define desired patterns of interaction and decision making. According to Holladay and Tytel, it helps clarify questions of identity (Who are we/Who am I?), focus (What's important to us/me?), and connection (How will we/I connect?) to inform decision and action to influence emergent patterns.

Resilience is the ability of a system to hold its integrity across space and time while adaptive to changing conditions. According to Barabasi, resilient systems are characterized by the following:

- ▶ They are sensitive to changes, challenges, and opportunities in the environment.
- ▶ They are responsive to those changes as they seek to relieve tension in the system and find best fit for optimal performance.
- ▶ They are robust, with multiple strong connections to ensure information, resources, and energy and are easily available across the system.

S

Scale refers to the level of organization in any given system. Systems are made up of parts that are made up of parts that are made up of parts. It is an infinite image of connection from the smallest of parts to the all-encompassing totality of the system. If you consider the place where you want to focus as the whole, then you can consider the next smaller scale (part) and the next larger scale (greater whole). Examples:

- ▶ *As an entity my immediate family is a whole. My two daughters and I are the parts. And we exist as a part of a greater whole that is made up of my three sisters and their families.*
- ▶ *At the same time I can consider my hand as whole and complete. It has parts that are the fingers and thumb, palm, nails, muscles, nerves, skin, etc. At the same time is it an integral part of the greater whole that is my body.*
- ▶ *A department in a business can be considered as a whole, with the individuals who work there as the parts, and the business overall as the greater whole.*
- ▶ *If an idea is whole and complete, its parts are the concepts and words that frame the idea, and is it a part of the greater whole, which creates a perspective or worldview.*

Scale-Free Dissemination is a method of distribution that takes advantage of the scale-free nature of a network. By sharing parameters and focused information and resources across the network, each node is able to use general rules and find its own best results to challenges and opportunities, while remaining coherent with the whole.

Self-Organization is the emergence of patterns in a complex adaptive system, resulting from the interdependent interactions of agents inside that system. Self-organization influences and is influenced by system conditions (CDE).

Semi-autonomous agents are the parts (individuals, groups, ideas, thoughts, traditions, etc.) that make up a system. They operate within system constraints, but they have enough freedom to respond to the tension in the system as they interact with each other. Because they respond in nonlinear ways to the unpredictable tension in the system, their behaviors are unpredictable. Observers may anticipate actions over time or across a large group, but they cannot predict what any one agent will do at a particular moment.

Simple Rules are systemic agreements that inform action to set conditions to shape emergent patterns in the processes of self-organization. Simple rules emerge from covert and/or overt agreement among the agents, informing decisions and actions to create coherence across the whole.

Strategic Adaptive Action is a process that enables coherent planning and action across a complex, self-organizing system. By establishing system-wide direction, a short list of simple rules, and explicit expectations and roles, this method of planning enables individual skills and opportunity for local planning and action. Based on the belief that local action fuels change at larger scales and that global patterns inform local ones, this model of planning informs action among local agents to enable most effective adaptation, with Adaptive Action cycles of many different lengths—short, medium and long—and scope—local, global.

T

Transformation is the emergence of new patterns of decision making and action that lead to system-wide change. It results when any condition of a system is changed so that a new pattern persists.

U

Uncertainty is the lack of stability that leaves you unable to predict or control the movement, path, or outcomes in a complex system. Uncertainty increases as the complexity of the system increases.

Resources

- Barabasi, A.L., 2003. *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life*. Plume.
- Carse, J. 1987. *Finite and Infinite Games: A Vision of Life as Possibility and Play*. Mass Market Paperback.
- Eoyang, G. 2001. *Conditions for Self-Organizing in Human Systems*. Unpublished doctoral dissertation. Union Institute.
- Eoyang, G., ed. 2003. *Voices from the Field: An Introduction to Human Systems Dynamics*. HSD Institute Press.
- Eoyang, G. 2012. "CAANs: Collaboration for the 21st Century." www.AdaptiveAction.org/blog. 20 June, 2015.
- Eoyang, G., Holladay, R. 2013. *Adaptive Action: Leveraging Uncertainty in Your Organization*. Stanford University Press.
- Habermas, J., 2003. *Truth and Justification*. Massachusetts Institute of Technology.
- Holladay, R., Tytel, M. 2011. *Simple Rules: Radical Inquiry Into Self*. Gold Canyon Press.
- Nations, M. Holladay, R. 2009. <http://patternsandpossibilities.squarespace.com/>. 20 June, 2015.
- Zimmerman, B.; Lindberg, C.; Plsek, P. 1998. *Edgware: Lessons from Complexity Science for Healthcare Leaders*. VHA Incorporated.