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CONDITIONS FOR SELF-ORGANIZING IN HUMAN SYSTEMS

by

Glenda Holladay Eoyang

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ABSTRACT

Self-organization is the spontaneous generation of order in a complex adaptive system. The phenomenon has been the subject of research in mathematics and physical sciences, and each discipline has generated models and methods that have been applied to human systems. This study introduces and investigates a model, The CDE Model, which integrates the diverse theoretical and practical approaches to self-organizing human systems. The CDE Model posits three conditions that serve as meta-variables to shape the speed, path, and outcomes of self-organizing processes in human systems. The conditions of the CDE Model comprise: Container bounds the system of focus and constrains the probability of contact among agents; significant Difference establishes the potential for change within the system; transforming Exchange connects agents to each other through a transfer of information, energy, or material. In this study, a Results Reversal method is used to investigate the efficacy of organizational interventions in which the CDE Model is used to assess, intervene in, and evaluate eighteen instances of organization consulting activity. The instances include four levels of organizational interaction (conceptual, team, institution, and community) and a wide variety of contexts (governmental, industrial, non-profit, educational, and informal groups). The efficacy of the model is supported in fourteen of the eighteen instances cited. The model has theoretical implications for human systems because it provides a simple, comprehensive, and consistent approach to understanding human system behaviors in widely diverse contexts. The model has practical implications as a coherent framework to compare and contrast a variety of traditional and innovative organizational interventions.

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GLOSSARY

Agent: An entity that has unique identity and the ability to interact with other entities.

Agents are semi-autonomous units that seek to maximize some measure of goodness or fitness by evolving over time. (Dooley, 1997).

In an organization, any entity can function as an agent for the purposes of self-organizing. Agents may include individuals, teams, departments, firms, or industries. In each case, the agent has an identity, makes choices for action, and interacts with other agents of the same or different type. Over time, a collection of agents can generate system-wide patterns of behavior or characteristics, while maintaining varying degrees of their semi-independent agency.

CDE Model: A set of the three conditions for self-organizing of human systems. The conditions include Container, significant Difference, and transforming Exchange. The path, rate, and outcomes of self-organizing processes are influenced by these three conditions, which are co-dependent such that the function of each of the conditions depends on the others in nonlinear interactions in the system. A change in any one of the conditions results in a change in the other two over time.

Coherence: The state of a system in which the parts fit together to establish system-wide patterns. Some of the emergent patterns in a self-organizing system are coherent, and others are not. Coherence is a state of the system in which:

- Meaning is shared among agents.
- Internal tension is reduced.
- Actions of agents and sub-systems are aligned with system-wide intentionality.
- Patterns are repeated across scales and in different parts of the system.
- A minimum amount of energy of the system is dissipated through internal interactions.
- Parts of the system function in complementary ways.

System-wide patterns in which the parts are aligned and mutually reinforcing (coherent) are more stable than other self-organized patterns. Because of the mutually reinforcing dynamics of a coherent pattern, the effort required to change the pattern is greater than the effort to maintain it, so coherent patterns are more stable than incoherent ones. When the system reaches a state of coherence, it has dissipated the entropic noise of its earlier stages, tensions within the system are reduced, and the available energy of the system is aligned and focused on system-wide behaviors, rather than diverse and disruptive behavior of individual agents or sub-system clusters.

Complex adaptive system (CAS): A collection of semi-autonomous agents whose interactions generate system-wide patterns.

A complex adaptive system (CAS) behaves/evolves according to three key principles: (1) order is emergent as opposed to hierarchical, (2) the system's history is irreversible, and (3) the system's future is often unpredictable. The basic building blocks of the CAS are agents. (Dooley, 1997).

Conditions: Characteristics of a system that establish the potential for self-organizing to occur. The three conditions for self-organizing that are investigated in this study include a container, significant difference, and transforming exchange. These three conditions are meta-variables that describe the functional roles within a system that establish the potential for self-organizing processes. In any given system at a given time, specific variable characteristics perform the function of each of the three conditions.

Container: One of three conditions for self-organizing in human systems. Any bounding condition that distinguishes a system from its environment.

Three different types of bounding conditions exist in human systems. Each can function as a container for the system's self-organizing. 1) A system may be enclosed by a defining external boundary, like a fence. Membership and physical spaces are examples of fence-like containers. 2) Agents in a system may be drawn toward a central attractive person or issue, like a magnet. A visionary leader or a motivating goal are examples of magnet-like containers. 3) Agents in a system may be attracted to each other by mutual affinity. Gender and cultural identity are examples of such affinity containers.

Multiple containers exist simultaneously in human systems, and they may be massively entangled. Each contains agents and system-wide patterns, but they may be coupled, so that the patterns within one container influence the patterns within others.

Conversation: Verbal exchange between or among individuals usually with specific intent to influence, to give or receive information, or to support shared decision making. Conversation is an example of a transforming exchange in a complex human system.

Conversation is one of the methods by which human agents interact to affect the level of coherence in the system.

Dynamical: Describes the motion of bodies in nonlinear relationship. The term is related to and derived from the term "dynamics," a branch of mechanics dealing with bodies in motion.

Instance: A situation in a human system that is defined as a research case for the purposes of this study. Each instance includes a presenting problem, intervention, and outcome of the intervention. An instance does not include longitudinal analysis or thick contextual description of environmental factors. Instances included in this study are selected to represent a variety of organizational scales, institutional settings, and intervention approaches.

Organizational effectiveness: In the context of this study, a pragmatic definition of organizational effectiveness is used, based on the presenting problem of the client. If the presenting problem is resolved, then the organizational effectiveness is improved. If the presenting problem is not resolved, then the organizational effectiveness was not improved by the intervention.

Presenting problems: Issues or concerns that are recognized by system participants and precipitate a request for professional intervention. Presenting problems are described in the terms used by the system participants, though it is frequently the case that other underlying issues are the genesis for the perceived problems that are described as "presenting problems."

Scales: Levels of interaction and organization within a human system. In a complex system, patterns and processes are repeated at various levels of the system. This reiteration of pattern is called "scaling," and can be observed when self-similarity is apparent in various levels within a system. For example, competitive behaviors between and among players can be observed within industries, corporations, teams, and individuals.

Self-organization: Process by which the internal dynamics of a system generate system-wide patterns.

". . . 'self-organization,' spatial and temporal organization that appears when the system is pushed away from thermodynamic equilibrium into a nonequilibrium region described as 'far from equilibrium.'. . . " (Smith, 1997, p. 61.)

Significant difference: One of three conditions for self-organizing in human systems. A distinction within a system that establishes a potentially generative tension, which represents the potential for change.

Significant difference can refer to a single parameter from among many that characterize the state of a system and influence its internal dynamics. For example, significant differences in organizations include power, resources, language, mission. Within a single parameter, significant difference also refers to a variation in magnitude that is sufficient to motivate systemic change. For example, the difference in power among co-workers may not constitute a significant difference, but the power differential between workers and supervisors may be significant enough to generate emergent patterns of behavior.

Transforming exchange: One of three conditions for self-organizing in human systems. A transfer of information, resources, or energy between or among system agents that results in changes within the agents and/or changes in system-wide patterns.

In organizations, exchanges may be formal (e.g., financial transactions or surveys) or informal (e.g., personal observations or conversations among co-workers). Exchanges take place between and among agents at all levels of a system: individual to individual, team to team, department to department. They also link across levels: team to individual; individual to organization; and so on.

CHAPTER I: INTRODUCTION

Problem Statement

A complex adaptive system (CAS) consists of a large number of interdependent agents whose interactions over time establish system-wide patterns of behavior (Dooley, 1996). This process of structure development is variously known as emergence (Goldstein, 1999) or self-organization (Prigogine, 1988). Scholars and practitioners have investigated the process of self-organizing in human systems by observing and recording its progress (Guastello, 1995), designing computer simulation models (Kaplan & Glass, 1995), and describing outcomes of the process (Bak, 1996). These investigations have been sufficient to indicate that human systems do spontaneously generate structures, but they have not produced an integrative model to explain how the processes progress.

In human systems, the process of self-organizing is particularly important. Teams, institutions, and communities include individuals or groups of individuals that function as agents in self-organizing. As the agents interact, patterns of behavior emerge over time. These patterns form and reform spontaneously and continually at multiple levels within the system. Individuals work together to form teams. Ethnic identity groups establish relationships and micro-cultures. Functional departments engage with each other to do the work of the organization. At all of these levels, agents interact naturally to form patterns of system-wide behavior.

The naturally occurring self-organizing patterns in a human system are multiple and are related in complex ways. One individual may participate in many different teams, for example. Each team supports its own self-organizing process and emergent patterns, and each of these emergent patterns influences the behavior of the team member in different ways. Every person at every level of the organization contributes to and is influenced by a myriad of self-organizing patterns.

Sometimes these patterns are disruptive to the stated intentions of the group, sometimes they are irrelevant to the work, and sometimes they are constructive. Different scales (e.g., individual, team, institution, community) or various parts (e.g., different departments or different individuals) within the system evince patterns, which are sometimes similar and sometimes divergent. When the patterns at various scales or parts do not fit together into effective working wholes, the self-organizing processes generate frustration, ineffective use of resources, and other symptoms that organization practitioners define as "presenting problems."

When the emergent patterns within and between groups are constructive, the people work together productively and smoothly. The behaviors of each part contribute to individual and group goals, and the human system is coherent. The goal of organization development interventions is to increase this harmonious behavior of the parts in the context of the whole. The goal is increasing coherence.

When organization development professionals design and implement interventions, they influence the self-organizing process of the human system. Effective organization development interventions increase the coherence of systems and decrease the

unproductive conflict of incoherent or disrupted system-wide patterns. An understanding of the underlying causal mechanisms of self-organizing behavior will help professionals design interventions that move the system toward more coherent behavior at multiple scales. To intervene wisely, it is not sufficient to know that a system has self-organized or that it is self-organizing. In order to influence the path of self-organizing, the practitioner must understand how the emerging patterns are determined by the interactions of the agents in the system. In order to investigate the process, researchers must have a theoretical model that establishes reasonable hypotheses about the mechanics of the self-organizing process in human systems (Lichtenstein, in press).

This study investigates a model (CDE Model) for self-organizing in human systems. The purpose of the model is to provide a set of meta-variables that describe the emerging dynamics of a human complex adaptive system. Because this model is simple and integrated, it will support organization development practitioners who want to understand the self-organizing nature of their systems. The model will support design, implementation, and evaluation of interventions that work with self-organizing processes to help increase system-wide coherence of human systems.

Background

Self-organizing behaviors of complex adaptive systems have been investigated in many different disciplines, including mathematics (Mandelbrot, 1983), engineering (Baker & Gollub, 1990), biology and ecology (Cohen & Stewart, 1994) and many others (Gleick, 1987). All of these approaches have been applied to describe the self-organizing behavior of human systems, but each one relied on context-specific models to describe the progress of self-organization. This process has resulted in an incoherent collection of causal models and descriptive scenarios related to self-organizing of human systems. If a complex adaptive systems view of human systems dynamics is to be a useful and enduring paradigm, rather than a fad (Stacey, et al., 2000), a coherent model will be required. The model will reliably describe the behavior of complex human systems, integrate insights from a variety of disciplines, and differentiate among the wide array of models and tools used to intervene in human systems.

Purpose and Significance

The purpose of this study is to propose and investigate a model that describes the conditions that shape the rate, path, and outcomes of self-organization in human systems. An integrated theoretical model of self-organizing in human systems provides a variety of benefits to both organizational theorists and practitioners. First, it brings together the principles of existing and diverse theoretical models of self-organization from mathematics, physical and social sciences to establish a hypothesis about how the system-wide patterns emerge. Second, it provides a simple model to help participants in CASs understand the complex processes and outcomes of self-organizing. Third, it provides a foundation for responsible action within a CAS. The study and its resulting hypotheses provide a foundation for further research and responsible action in complex human systems interactions.

Hypothetically the model may be informative for understanding and action within human systems at any scale and in any context. The current study, however, investigates the model in four scales of organizational systems: conceptual, team, institution, and community and a variety of organizational contexts, including government, industry, non-profit, education, and informal groups.

Nature of Study

The study is a theoretical contribution to the field of human systems dynamics, a field of research and practice related to processes that generate and maintain structures and relationships within human collectives. The study introduces and investigates a model for the conditions for self-organizing in human systems that has emerged from research in the field and personal experience as an organization development consultant. The model is applied to assess, intervene in, and evaluate the outcomes of eighteen instances of organization change and development. Each instance involves a presenting problem, analysis of the environment based on the model, intervention, and evaluation of the intervention. These instances are not detailed case studies, but focused action and analysis of a single situation over a limited period of time. A Results Reversal Method, is used to collect, document, and analyze the data in the study. The study investigates the following hypotheses:

H_1: Interventions that change one or more of the conditions for self-organizing (container, difference, exchange) change the coherence of the system.

H_2: Interventions that increase the coherence of one level of the human system increase the effectiveness of that organizational level.

CHAPTER II: THEORETICAL GROUNDING

Literature Review

Two points of view shape the foundations for the model of conditions for self-organizing in human systems that is described and investigated in this study. The first comprises the rich scholarly tradition of research into the behaviors of human systems as complex adaptive systems. The second is the subjective experience of the researcher that integrated received theory with emergent practice over a period of years. Both of these strands are described in this section as the foundations from which the model emerged. The final section of the chapter provides a summary of the model of the conditions for self-organizing in human systems.

Research and practice in the dynamics of human systems has a long and complicated history. Beginning with the earliest historians Herodotus (484-425 BC) and Thucydides (460-400 BC) scholars sought to describe how the beliefs and behaviors of individuals and groups emerged over time. Philosophers from ancient times (e.g., Aristotle's study of politics) through scholars of the present day (e.g., Habermas, 1973; Foucault, 1979; and Wilber, 1995) have investigated the underlying assumptions and dynamics that shape the behavior of humans and their systems. Movements in management science, beginning early in the last century (Taylor, 1912; Follett, 1918), focused not just on understanding but shaping and controlling the paths and outcomes of human systems. Beginning in the 1930's, Lewin (1936) and others at the University of Iowa refined what they called "field

theory" and opened a dialogue of theory and practice that evolved into the field of applied behavioral science. Interactionism was one of the key assumptions of this theoretical base and holds that behavior is a function of both the characteristics of people and the characteristics of the environment. The formula B= f (P,E) summarizes the assumption. In the context of a work group, the formula implied that the behavior of group members (B) is a function (f) of the interactions of personal characteristics (P) with environmental factors (E) which include features of the group, its members, and the situation. These factors combined to form what Lewin called the lifespace, which represents a closed system that accounts for any factor that affects behavior.

In 1945, Lewin established the Research Center for Group Dynamics at MIT where he and colleagues continued to study the consequences of interdependence among group members. These studies included examination of leadership climates, industrial productivity, and the influence of groups on attitudes. This Lewinian theoretical base marked the beginning of the study of group dynamics. The purpose of this theory-based practical field was to help shape individual, group, and institutional response to organizational change and its manifestations. Most of these scholars sought models and theories that would make behavior of human systems comprehensible, if not predictable and controllable. Some focused on systems (Ackoff, 1972; Senge, 1990), some on learning (Schon, 1983; Argyris, 1993), some on the process of change (Bennis, 1966; Weick, 1979; Weick, 1995). Some focused on metaphors (Morgan, 1997; Lakoff & Johnson, 1980; Tsoukas, 1991), and some on psychological implications (Maslow, 1968) or leadership (Schein, 1985).

The organization development and management literature of the past century presents rich and varied models for thinking about and acting within complex human systems. Each individual theory or approach to practice provides some relevant insight into behaviors of complex human systems. The organization and management literature alone could form a theoretical foundation of sorts for the current study, but no underlying theoretical model has been embraced by the field as a whole. A review of this literature would involve a process of cataloguing, comparing, and contrasting previous theories and practices to an emerging complex dynamical approach. This exercise would merely justify each in terms of the other without moving toward a consistent and coherent explanatory model that has the potential to integrate the various perspectives into a meaningful whole. In contrast, the current study draws its theoretical grounding from the related fields of nonlinear dynamics and chaos theory. These fields, too, are currently without unifying theoretical bases, but they do derive their findings from a small set of observable and commonly understood phenomena, which provide at least a hope of emergence of a coherent and generalizable theoretical framework. For this reason, the current theoretical grounding of the work will be based on literature drawn from the fields of nonlinear dynamics, complex adaptive systems, and chaos theory.

The study of nonlinear dynamics and chaos theory introduced a new set of underlying assumptions and models to describe the behaviors of unpredictable and uncontrollable systems in the physical universe (Gleick, 1987; Lewin, 1992; Waldrop, 1992). Social scientists were quick to recognize the analogues between the turbulent and emergent behavior of some physical systems and the previously perplexing behaviors of human systems. This realization introduced a new line of inquiry for scholars and practitioners of