

CONDITIONS FOR SELF-ORGANIZING IN HUMAN SYSTEMS

by

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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:

H₁: Interventions that change one or more of the conditions for self-organizing (container, difference, exchange) change the coherence of the system.

H₂: 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

organization development. Some began to use the tools from physical sciences, including mathematical and computer simulation modeling and time series analysis, to investigate the behavior of human systems (Van de Ven & Garud, 1994; Kiel, 1994; Guastello, 1995; Poole, et al., 2000). Other researchers applied the metaphors emerging from complexity research, including fractals, boundary conditions, attractors, and sensitive dependence on initial conditions, to describe the phenomena they observed in human systems (Goldstein, 1994; Stacey, 1992; Wheatley, 1992; Eoyang, 1997; Stewart & Cohen, 1999). At the same time that the social scientists were applying the findings of chaos and complexity to issues in human systems, the work in the mathematics and physical sciences continued to emerge.

In the field of mathematics, researchers pursued the study of fractals (Mandelbrot, 1983) and catastrophe theory (Thom, 1975). Engineering disciplines focused on deterministic chaos (Baker & Gollub, 1990), self-organized criticality (Bak, 1996), synergetics (Haken, 1977), and systems dynamics (von Bertalanffy, 1968). Thermodynamics introduced the concept of dissipative structures (Prigogine & Stengers, 1988). Researchers in biological systems introduced models for autogenesis and autopoiesis (Maturana & Varela, 1980) and emergent evolution (Gould, 1992). Those who study information sciences and computer simulation modeling introduced the concepts of complex adaptive systems (Holland, 1998; Holland, 1995), simulated annealing (Watson in Coveney & Highfield, 1995), cellular automata (Margolus & Toffoli, 1987), and fitness landscapes (Kauffman, 1995).

Each of these emerging investigations was quickly incorporated into organization and management theory. Lichtenstein (in press) describes thirteen fields of complexity research and their implications for management theory and practice. Each model spawned a somewhat internally consistent set of metaphors, tools and models that were separately applied to investigation of human systems. Zimmerman and Hurst (1990) used the image of the fractal to point out how organizations exhibited self-similarity across scales. They found similar meanings and patterns established at the individual, group, and corporate levels within the same organization. The work focused on domains or contexts in which human systems emerge and the patterns of similarity and differences perceptible between and among contexts. Guastello (1995) applied the patterns and concepts of catastrophe theory through time series analysis to investigate continuous and discontinuous change in behavior of human systems. Using the paradigmatic cusps of catastrophe modeling, the researcher classified organizational dynamics according to the numbers of dimensions of difference that shaped behaviors. His work articulates the relationships between overall patterns of behavior and the number of critical differences that shape those dynamical patterns. Using the principles of deterministic chaos, Kiel (1994), Abraham (1997), Cheng and Van de Ven (1996) identified emergent order in the form of attractors from data that appear to be random.

An attractor is a pattern that emerges through time in a chaotic system. The pattern has finite bounds, but the behavior of the system within those bounds is infinitely complex, discontinuous in time, and includes isomorphic patterns repeated in various scales and parts of the system (fractal in structure). These researchers used the concept of

differences through time and within constant bounds and this set of tools to uncover and describe self-organizing structures in institutional situations.

Bak (1996) applies an emerging theory of self-organized criticality to issues appearing in human systems. Self-organized criticality refers to the propensity for a complex system to go through periods of continuous change, then to shift precipitously to large-scale changes. The power law that he articulates demonstrates a constant ratio, or predictable pattern, among the sizes and frequencies of changes in a system. Stanley, et al. (1996) applies the power law to investigate the emergence of human system structures. This work sets a context for understanding the relationships that evolve between various scales of system behavior as a system self-organizes.

McKelvey (1999) applies the principles of Kauffman's (1995) NK model of fitness landscapes to represent how an organization co-evolves with its market and environment. This model focuses on relative fitness of agents within the same environment and the relationships of the environments with each other. The environment determines the fitness of actions taken by agents on the landscape. McKelvey (1999) uses this model to investigate value chain relationships and to generate new value chain strategies. The fitness criteria, called fitness parameters, in the environment represent "differences that make a difference" to the survival of the firm within the given business environment. Landscapes are also used to define defensive business strategies (Reidley, 1999).

Cellular automata find their way into organizational theory and practice by way of "minimum specifications" (Zimmerman, et al., 1998) and "simple rules" (Olson & Eoyang, 2001). The principle is that coherent patterns will emerge from a group of

interdependent agents, if they all follow the same list of rules. The rules determine the differences that make a difference at the agent level. Transfer of information among agents and between the agents and the environment establish self-organizing patterns across the whole. In a cellular automaton, each agent follows rules in a local context, responding to the behaviors of their nearest neighbors, but not being constrained by the emerging pattern of the whole.

In the field of complex adaptive systems, on the other hand, interdependent, but semi-autonomous, agents follow a few simple rules to generate system-wide coherence. The emerging system-wide structure shapes the behaviors of the agents in later iterations. This extends the model of the cellular automaton to include interactions of changes across a system-wide scale. Dooley (1997) and Olson and Eoyang (2001) apply these principles to investigate individual and organizational change over time. Carley and Svoboda (1996) use the simulated annealing process to model organizational adaptation. The underlying principle is that optimal moves of individual agents are alternately constrained and unconstrained. This leads to adaptive response and improved fitness of the agent (individual or organization) over time. The variation in constraint serves as a container for the system's self-organization, and the changes in state are effected by exchanges of energy and information between and among the agents and the environment.

Zuijderhoudt (1990) and Haken (1984) investigated applications of synergetics to organizational behavior and management. Synergetics, which was initially used to develop the laser, defines control and order parameters that set nonlinear relationships

between multiple scales of behavior (Haken, 1977). A linear change at one scale generates a nonlinear change at another scale. This model can be used to investigate co-evolution between systems and self-organization within a system.

Sastry (1997) and Senge (1990) applied the principles of traditional systems dynamics to investigate the effects of positive and negative feedback on a system as it self-organizes. This approach provides an explanation of unintended consequences and leverage points in system behaviors. Stacey (2001) rejects many of the tenets of traditional systems dynamics, but does focus on the role of engagement and feedback in self-organizing behaviors of human systems.

Autogenesis and autopoiesis focus on replication of patterns that exist within an organism or an organization. By creating and replicating rules, a system builds its internal coherence in an emergent, self-organizing process (Pantzar & Csanyi, 1991). For these researchers, the identity of the system and the internal replicating dynamics constitute the process that generates self-similar structures.

Kontopoulos (1993) used the principles of dissipative structures to explain how and why social structures emerge. This approach from thermodynamics (Prigogine & Stengers, 1988) posited that when a system is moved far from equilibrium, it generates new structures to dissipate its accumulated entropy. The result is new, and usually more complex, structures in social organizations.

Finally, the images of exploration and exploitation that come from emergent evolution have been applied in a variety of contexts to explain how and why human systems self-

organize. March (1994) used this metaphor to describe an adaptive decision-making process. Hannan and Freeman (1993) used the model of ecology and evolution to describe the unpredictable change processes in organizations. Baum and Singh (1994) used evolutionary processes and other sources to describe the development and adaptation of firms.

Some management and organization development writers who focus on the popular or business market (Eoyang & Berkas, 1999; Wheatley, 1992; Goldstein, 1994; Kelly & Allison, 1998; Petzinger, 1999; Lissack & Roos, 1999) draw upon many of these scientific and mathematical disciplines simultaneously to generate tools and advice for practitioners. These scholars have provided a set of tools, but they have not yet provided an integrated theory base for the investigation of human systems as complex adaptive systems.

All of these research strands and their resulting models, theories, tools and techniques deal with phenomena that share fundamental patterns of behavior. The tools used to investigate, the languages used to describe, and the tools and techniques recommended for human system intervention are quite distinct, however. "What is the essence of this diverse stream of writing and research? Is there a way to organize the multiple approaches into a coherent framework? Why is such a broad range of writing being labeled as 'complexity'?" (Lichtenstein, in press, p. 4). A coherent and integrating model is necessary if the insights of complexity are to become a coherent paradigm in the study of human systems.

Evolution of the Model

The model of the conditions for self-organizing human systems emerged over a period of twelve years and myriad experiences. The model had roots in earlier educational, personal, and professional experiences and involved numerous cycles of theory investigation and practical application. Each new insight formed the grounding for the next question or action. The unpredictable, nonlinear developmental process presented difficulties in attempting to describe a model or to arrive at a rationale for sequences of events. What was needed was a formulation that would lead to understanding of this theory of organizational behavior, and a coherent and functional model of the mechanisms for describing self-organizing processes in human systems. The model development was not a simple, intuitive leap. In various contexts, questions and tensions arose that pushed the development along. Conversations with clients, fellow learners, and experts in a variety of fields provided the opportunity to recognize, formalize, and articulate the model through its various stages of development.

The following sections describe the incidents and factors that were critical in the model development. The purpose of this description is to document the various roots of the model in practical experiences and theoretical learning.

Study at St. John's College

From 1972 through 1976 this writer studied the Great Books at St. John's College in Santa Fe, New Mexico. The St. John's approach emphasizes primary sources, dialogue as a means of learning, and an interdisciplinary, all-required curriculum. The Program

established a foundation for later work in the field of complex dynamics in many ways. In the curriculum, students were introduced to the discipline, history, and philosophy of the natural sciences and were immersed in emergent conversational contexts thereby framing the underlying questions that motivated this writer and shaped the development of a model for self-organizing systems.

Of the many queries posed during this researcher's education at St. John's, two major questions arose that were related to the development of the model for self-organizing systems. The first is framed in Plato's Sophist and concerns the relationships between same and different, being and not being, and knowing and not knowing. The creative tensions between and among these pairs generates, for Plato, the reality that we use to make meaning as a society. These same distinctions appeared to be central to the self-organizing dynamics observed as groups tried to work together. How do differences enrich understanding? How do similarities hold groups together? How can agreement be reached on what does and does not exist as relevant to workplace practices? Of what can one be certain, and what remains unknowable at this time and place? Ultimately these questions made their way into the model as significant "differences," "containers," and transforming "exchanges."

The second fundamental question dealt primarily with change and its causes. Hegel (1807) introduced the possibility that change emerged from the creation and engagement of opposites. The thesis generates its antithesis spontaneously. Engagement between thesis and antithesis results in the emergence of the synthesis. The dialectical mode of creation became, for this writer, a model of emergent behavior that helped to describe the

mechanism of exchange between significant differences resulting in new, system-wide patterns of meaning or behavior.

The dialectical learning process of St. John's also served as a laboratory of nonlinear human systems interaction. Over the course of four years, this writer participated in and observed hundreds of class sessions. Each session was a living example of a self-organizing system. Characteristics that shaped the self-organizing process were differences in perspectives and levels of understanding among students and tutors; respectful exchanges including listening, speaking and reading; and the "containers" of membership, time, place, and a focus on a particular text. When any one of these conditions was absent or distorted, the group failed to work effectively as a group. When the conditions were met, new coherence emerged in the forms of individual and group learning.

Contact with Communities of Scholars and Practitioners

The study of chaos and complexity is a relatively new field in the natural sciences, and its application in the social sciences is even more recent. In the past ten years, the field of organizational application of complexity has emerged through frequent interaction among scholars and practitioners. This writer has been privileged to participate in this evolution by working with colleagues and studying their writings. Some specific incidents that were critical to these emerging personal theories are described below. The Chaos Network and Society for Chaos Theory in Psychology and the Life Sciences are two groups formed in the early 90s to bring together researchers and practitioners in chaos theory and theories of complex adaptive systems. The first Chaos Network Conference in

1991, was a critical point in this writer's emerging understanding of complexity theory and the society of professionals who move these concepts and ideas forward. During this conference, individuals provided insights and have continued to challenge, inspire, and inform this work. Subsequent conferences provided opportunities to hear from others and present and test these developing ideas. Several specific ideas related to the conditions for self-organizing emerged from interactions with other members of these organizations.

Two are particularly relevant.

Goldstein (1994) introduced the notion of difference questioning into the field of chaotic human dynamics. He pointed out that differences among members of a group are valuable sources of learning and insight, and that they should not be damped or ignored. Watching Goldstein work, working with him, and talking with him about his work convinced this writer further that significant differences were central to the self-organizing processes that brought coherence to small group and institutional learning.

Wally Hlvac, in a personal conversation, described "equilibrium" in his organization in a surprising way. His descriptions of equilibrium conditions were based on flow and energy and heterogeneity. His metaphors were topological and multi-dimensional. Prior to that point, this writer had thought of equilibrium as a kind of balance of this against that, and held a mental image of equilibrium in a two-dimensional world in which position and mass were the only "differences that made a difference." This conversation with Dr. Hlvac opened up the possibility of far-from-equilibrium conditions moving a high-dimension system toward increasing coherence.

Theoretical Works in the Physical Sciences

Research in the behavior of complex adaptive systems has been fragmented across many different disciplines. Reading widely in the various disciplines, and as deeply as possible, provided a large number of metaphors and optional ways to describe the dynamics that support self-organizing in human systems. Three examples are described below.

Prigogine and Stengers (1988) introduce the concept of dissipative structures. These are self-organizing structures that are spontaneously generated when a dynamical system is moved far-from-equilibrium. The roots of this theory lie in the dynamics of thermal and chemical systems. The metaphor was a good one for the nonlinear developmental processes experienced in this writer's learning and in groups. Prigogine included descriptions of conditions that set the stage for a system to move far-from-equilibrium and to establish new dissipative structures. They included a boundary that separates the system from its environment (container), a chemical or thermal gradient between the system and its environment and/or within the system itself (significant difference), and the ability of the system to transfer energy from one part to another (transforming exchange).

Bak (1996) describes the phenomenon of self-organized criticality. The theorist's primary metaphor is the sand pile. As new grains of sand land on the pile, the pile responds in various ways. Nothing may happen, a small cascade may begin, an all-out avalanche may destroy the structural coherence of the pile. This research shows that the frequency of small and large responses is related by a simple mathematical ratio ($1/f$). In other words, the size of the event is inversely proportional to its frequency. This same relationship

appears in many different contexts, including word usage, earthquakes, and workplace accidents. The mechanism that Bak posits to explain this strange relationship is that small changes at smaller scales accumulate over time. At critical points, these accumulated small-scale changes generate tensions, which over time result in changes at larger scales. This model became the foundation of the connection across scales of self-organizing in human systems. Self-organizing processes at smaller scales (individual learning) over time generate differences in larger scales (groups). The differences between individuals accumulate as tensions in the group as a whole. Eventually, the larger system must self-organize to resolve the internal tension.

Kauffman (1995) describes fitness landscapes as a way to visualize the interactions of agents in a simulation model. Agents exist on a landscape (container) in which some states are more fit for survival (differences) than others. Agents take action (exchanges) in iterative processes to move "up" or "down" on the fitness landscape. Kauffman goes on to discuss how a single agent can function in multiple fitness landscapes simultaneously. The landscapes can be coupled, so that a move in one affects the fitness criteria and the fitness of the agent on another landscape. This model provided a method to visualize and to relate multiple containers for self-organizing processes and to relate the differences and exchanges in one container with those in another. Kauffman (1995) also describes a related model in which the number of agents and the number of connections between the agents determine the stability or predictability of the system behavior. Too many connections tie the system into an unchanging pattern. Too few connections keep the system from settling into any pattern at all. The "right" number of connections among agents allow for flexibility and adaptability. This metaphor reflected this writer's

experience with groups, in which too many transforming exchanges stifled creativity and change, while too few left the group without any coherent pattern at all. Of course other texts helped shape the emerging model of conditions for self-organizing, but these three were critical in helping to identify the three conditions and to investigate how they were related to each other and to the emerging coherence of the system.

Nonlinear Dynamics

As part of The Union Institute program, this writer attended a course at the University of Minnesota in nonlinear dynamics and time series modeling. One of the texts used was Understanding Nonlinear Dynamics (Kaplan & Glass, 1995). In addition to introducing many new skills and concepts, this course deepened this writer's understanding of attractors as emergent patterns in complex adaptive systems. During the class students worked with time series analysis as a method to investigate the behavior of nonlinear systems. A time series approach to the study of nonlinear system behavior involves sampling the system at regular intervals over a long period of time. If the system is technically chaotic, when the data are plotted in phase space (indicating relationships among non-time variables) patterns emerge. These patterns, called attractors, provide an image of the internal system dynamics.

Sufficient research has been done to demonstrate that human systems sometimes generate coherent attractors (Guastello, 1995, Eoyang & Stewart, 1996). Examples of attractors in human systems include patterns that emerge from accident rates, stock market behavior, and coherent conversations. Analysis of the attractors (at least in low-dimension systems) allows the researcher to posit a set of coupled, nonlinear equations that model the

behavior of the system. This approach also presented the possibility that some small number of variables, in nonlinear relationship to each other, could model the genesis of the dynamic patterns that result in apparently unpredictable behavior. This approach supported observations that coherent patterns do emerge over time in human systems and fueled the expectation that some such model could be derived for the self-organizing patterns in human systems.

Participating in Groups

In the course of the past ten years, this writer has participated in a variety of group interactions. Each of these became an opportunity to observe complex dynamics and to test the emerging model of self-organizing behavior in human systems. NTL Human Interactions Laboratory, Union residency experiences (colloquium, seminars, peer days), meetings with clients, group interventions that included facilitated sessions all contributed data about the ways that groups of individuals function. Across all of these environments, the three conditions (container, difference, and exchange) appeared to be the most consistent characteristics of the interactions that determined whether the group would move to increased coherence in terms of individual learning and/or shared meaning for the group.

Meeting Clients' Needs

Throughout this period, this writer continued to work with clients on a variety of issues and concerns. Each engagement provided an opportunity to posit and test emerging hypotheses about self-organizing processes in human systems. Two experiences were particularly critical in the development of the model for conditions for self-organizing. In

1994, a client was in the midst of contentious union negotiations. The path of the work and the stability of the organization had been unpredictable and difficult over the previous year. This writer began to work with the client and asked the client to tell the story of the progress of the work. The story was then transcribed and coded for characteristic behaviors of chaotic systems. Though ten patterns of chaotic behavior were considered in the coding process, three appeared in the same sequence repeatedly. The system members would articulate a problematic issue (significant difference). Communications around the issue would increase (transforming exchange). New understanding or agreement would emerge (system-wide pattern formation). Perhaps this pattern emerged in the telling of the story rather than the behavior of the system, but the iterative cycle of difference, exchange, new pattern was so pervasive that the writer began to use it as a way to track development of other groups over time. It proved helpful in analysis. The next step was to make this pattern understandable and accessible to clients and others.

About three months later, the second experience arose in the facilitation of a rather difficult conversation between law enforcement officials and community members who were interested in implementing a restorative justice program. The dynamic interaction between difference and exchange allowed for clear illustration of possibilities and facilitated assessment of difficulties in their system. This writer developed the Difference Matrix as a way to articulate these complex interactions.

Figure 1. Difference Matrix

	High Difference	Low Difference
High Feedback	1 Contention Disagreement New learnings Shared understanding	2 Singing to the choir Little new productivity Comfortable Reinforcing
Low Feedback	3 Avoidance Fear and anxiety Individual reflection Safety	4 Boring Entropic Passive Quiet

This model was shared with clients and used to help them recognize and manage their internal dynamics. They could see that they moved, as a group and as individuals, from one to another of the quadrants. The fact that this model was so intuitively useful to this client supported this writer's observations that difference and exchange were central to the emerging coherence in human systems.

The Difference Matrix was then tested in various system interventions. The difficulty clients had in using and understanding this model always revolved around questions like, "Difference in what?" or "Feedback between whom?" To respond to this question, the writer began to make explicit that these dynamics were happening in many different contexts at the same time. Power, money, place, topic, personal style, language were all different dimensions of dynamical interaction, and each one had its own Difference Matrix. In struggling to come up with a way to talk about dimensions without confusing the issue, it was decided that the consultant would begin to call each of these domains a "container."

This section has outlined some of the critical incidents in the unpredictable and nonlinear path that led to the articulation of the conditions for self-organizing in human systems.

There is no doubt that the model will continue to evolve in both theoretical and practical implications. The model, itself, is the coherent result of a complex adaptive process, so the on-going life of the approach will be shaped by its own set of conditions for self-organizing. At this point, it is impossible to predict the containers of interest, the significant differences, and the transforming exchanges that will shape patterns in the future.

Self-Organizing in Human Systems

Self-organization is the process by which a system generates new system-wide patterns over time based on the system's internal dynamics. This section describes the process of self-organizing and establishes the foundation for the CDE Model of the conditions for self-organizing in human systems.

Internal Dynamics

As a structuration process, self-organizing differs from others because the new patterns are not designed outside and imposed on the system, but they are generated by the interactions of the system's agents with each other over time. Because system boundaries in a CAS are multiple, fluid, and massively entangled, the "internal interactions" happen at various scales and interlocking patterns emerge at various places across the system and throughout the time period of the self-organizing process. Clusters of agents form micro-patterns continually. These micro-patterns interact to form larger, more comprehensive patterns or disrupt each other during the on-going evolution of the system. At the same time, emergent patterns in a super-system influence the emerging patterns in sub-systems and in individual agents by either reinforcing or disrupting their local self-organizing processes.

Continuous Development

Though it may be helpful to think of self-organization in terms of iterated cycles of activity, the process of self-organizing is continuous. New patterns appear at different scales simultaneously--between two agents, among small groups of agents located in

different parts of the system, or between multiple sub-system patterns as they emerge. New patterns appear in different local contexts of the system at the same time. During the self-organizing process, a variety of patterns emerge. Some of them are amplified and strengthened by subsequent actions in the local or adjacent contexts, some are damped or interrupted by subsequent action among the same agents or with other system agents. A snapshot of the system's patterns at any moment reveals patterns that have emerged previously, but it does not pre-determine patterns that will be present in the future of the system. Thinking about the system in terms of periodic iterations simplifies the conceptualization of the process, so that the system can be seen as moving from one semi-stable state to another. In reality, however, the self-organizing process across the system as a whole is continuous.

Characteristics of a Self-Organizing Process

Three characteristics can be used to describe the self-organizing process within a given system boundary: Path, speed, and product. The path of the self-organizing process describes the interim patterns that are established during the course of self-organizing. A sequence of intermediate patterns appears prior to the emergence of a pattern that is recognized as a stable, self-organized system state. This sequence constitutes the history of the system and can be observed as the path of the self-organizing process.

The speed of self-organizing is determined by the time elapsed between the initial status of the system as individual agents and its achievement of a coherent system-wide pattern. Because the self-organizing process is continuous and dependent on initial conditions, the "start" and "end" times that are used to determine the speed of the self-organizing are

somewhat arbitrary. "Initial" and "final" states, however, provide a functional way to distinguish a particular self-organizing process from those that occurred before or after in the same system space or simultaneously in another part of the macro-system.

The product of the self-organizing process is the system-wide pattern that characterizes the system at a particular stage of its evolution. The pattern produced by the self-organizing process may be characterized as stable or unstable and as coherent or incoherent.

Stability

Some of the patterns that emerge in the system as it self-organizes are more stable than others. Stability depends on the balance between the energy or effort required to sustain the pattern and that required to disrupt the existing pattern. If more effort would be required to disrupt the existing pattern than to maintain it, then the emergent pattern is stable. If more energy would be required to maintain the emergent pattern than to disrupt it, then the emergent pattern is unstable, and it will dissipate over time to be replaced by a more resilient pattern. Over time, the myriad, emerging local patterns "compete," and those that are most stable maintain structure over time and constrain the probability of new, stable patterns forming. When stable patterns are maintained over a period of time and across the system as a whole, the system can be recognized to have "self-organized."

In some systems, the internal dynamics hold the system in a stable state by working against change or emergence of new patterns. This, too, is a process of self-organization. The internal interactions in the system generate a system-wide pattern that is stable and unchanging. The conditions are the same for self-organizing processes whether they

generate innovative or traditional system-wide patterns, though the specific incarnations or values of those conditions may be quite different.

Coherence

Coherence is the state of the 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.

Not all self-organizing processes, however, lead to coherent behavior at a particular level or scale. Self-organizing processes that are acting at lower levels within the focus scale or higher levels surrounding or intersecting with the focus scale, can take precedence over self-organizing processes of current focus. In such situations, coherence within one set of system boundaries is sacrificed by the system in preference to more stable and resilient self-organizing patterns within another set of system boundaries. For example, one individual's coherent belief structures may persist and disrupt his or her ability to participate in patterns of behavior that are coherent within the boundary of a team. Or, institution-wide patterns may maintain their coherence and dissipate the potential for a team to establish new ways to work together. In this way, self-organizing at different levels or within different sets of system boundaries may disrupt the self-organizing processes within a given domain, boundary, or container.

Any approach to self-organizing in human systems introduces complex issues about the nature of the system and the nature of interventions to affect the system's dynamics.

Though many of these questions are beyond the scope of this study, a brief discussion will provide context for the theoretical and practical issues that the study does address.

The process of self-organizing can be considered as a cognitive construct to explain observations and patterns perceived in systems. In this epistemological view, emergence is a conceptual construct representing the characteristics of the observer more than the observed. Alternatively, self-organizing can be proposed as a natural phenomenon, with ontological reality, existing apart from any observer. This distinction, though interesting, is beyond the scope of this study. The model articulated and investigated in this study has

practical application, whether the phenomenon it describes has cognitive or physical existence in reality.

This study assumes that self-organizing processes in human systems are analogous to those in physical systems. Human agents are conscious, exercise free will, and express intentionality, while agents in physical systems do not. In both cases, however, interactions of agents within the system generate observable system-wide patterns.

Perhaps, at some level of system structuration, the same conditions shape self-organizing in both human and physical systems, but this study focuses solely on the self-organizing processes as they appear in human systems at the level of conceptual, team, institutional, and community development.

Organization development practitioners intervene in system dynamics to influence the emerging patterns of behavior and meaning. It would be difficult to consider the emergent processes in a human system as self-organization if the practitioner functioned as an objective, external agent. The assumption in this study is that the consultant takes the role of an active agent in the system and becomes a part of the self-organizing whole. He or she participates in the emerging dynamics and equally influences and is influenced by the processes of self-organizing.

Self-organizing processes are essentially value neutral. There is no guarantee that the results of an emergent process will be better or worse than the previous state or any other alternative state. In human organizational situations, however, some states are judged to be better or worse than others. For the purposes of this study, three factors were used to indicate the organizational preference for one outcome over another: clients' expectations,

stability, and coherence. As a guide to action and evaluation, these three criteria serve to distinguish successful interventions from unsuccessful ones, though the self-organizing processes themselves cannot be judged as more or less successful. In addition, the context of the interventions may determine that a client's expectations did not serve a system well in the long run. It may also be true in some circumstances that instability or decreased coherence is more conducive to system sustainability than stability or coherence.

Ultimately, fit with the environment is the gauge of survival and success for self-organizing systems, but within the constraints of this study, expectations, stability, and coherence will be used as measures of success.

Conditions for Self-Organizing in Human Systems

The research and on-going experiences described above led to the emergence of a model to describe the rate, path, and outcomes of self-organizing processes in human systems.

The model establishes a set of three meta-variables whose coupled interactions, through time, shape the patterns that emerge from nonlinear dynamics in human systems. The meta-variables, defined as the conditions for self-organizing in human systems, constitute three dimensions: Container, significant difference, transforming exchange.

Container

Any self-organizing system is distinguished from its environment in some way. The physical boundary or the bounding process that embodies the distinction between the system and its surroundings functions as a container during the process of self-organizing. The container constrains the system's agents while new structures or relationships form between and among them. The purpose of the container is to hold the system together, so relationships between and among agents can be established. In essence, the container increases the probability that any two agents will engage constructively with each other and establish the foundation for self-organizing patterns to emerge. The container is a necessary condition for self-organizing processes. If there is no constraint on the agents, if there is nothing that defines the agents as a group, if there is no condition that increases the probability of contact among the agents, then the agents dissipate, and no new system-wide structures or patterns can form.

Three types of relationships or forces have been identified to perform the function of a container in human systems.

A system may be contained by an external boundary. These containers can be defined as fence-like because they delimit the outside boundaries for the system. Examples of such containers include a room, information system firewalls, and membership criteria. Each establishes the defining or outside bounds of the system of agents that will participate in self-organizing processes. They constrain the agents into a shared space in which they can build their self-organizing patterns.

A system may be contained by some central attracting force. These containers can be described as magnet-like because they draw system agents into proximity to each other. Examples of magnet-like containers include a charismatic leader, a clear and shared vision, and a desirable resource. Each of these forces will draw system agents together and increase the probability that they will interact in ways that will lead to self-organizing patterns.

A system may be contained by one-to-one attractive forces between agents. These forces can be defined as affinity-like containers. Examples of affinity-like containers include gender and ethnic identity, shared language, and trust. Each of these (fence, magnet, or affinity container) constitutes a condition that pulls individual agents together and increases the probability that they will self-organize into a coherent whole.

Multiple containers exist simultaneously in any human system. Not all of them may be actively engaged in the process of self-organizing at any given moment. For example,

when a cross-departmental team meets in a room, their path of self-organizing may depend on their organizational loyalties (affinity), their disciplinary jargon (fence), or the purpose that brought them together (magnet). Any or all of these containers may be active at any moment in time.

Containers are massively entangled. Any agent may participate in numerous containers at the same time, and each container can affect the self-organizing processes within the agent. Sometimes, containers are nested simply one inside another (cubicle, floor, building, neighborhood, city). Sometimes, they are co-located (two people working together across departmental lines, while still participating actively in the containers that define their professional disciplines, departments, ethnic groups, and genders). All strands of research in complexity either address or assume a system container. A container, though necessary, is not a sufficient condition for the self-organizing process to emerge. If agents in the system are homogeneous and/or inert to transforming connections, then no new structures or patterns will organize within the container.

Significant Differences

Within a container, difference establishes a potentially generative tension, which represents the potential for change. In complex adaptive systems information, material, resources, and energy flow from source to sink--from high potential to low potential states. Difference is the meta-variable defined as any distinction within the system that constitutes a potential for movement. The purpose of the difference is to give the possibility for movement and engagement that results in self-organization to new structural states.

Difference is a necessary condition for self-organizing to occur, and the magnitude of the difference must lie between maximum and minimum thresholds. If all of the agents of the system are identical, the difference in the system is below the minimum threshold. No interaction will take place, and no new system-wide patterns will emerge. If the difference in the system is too great, above the maximum threshold, then the system will not be able to sustain connection among the agents, and it will split, or bifurcate.

Two types of differences are significant in complex adaptive systems. Difference along a single dimension can support self-organizing. If the difference is significant to the agents, and if the difference is not too great, a difference in a single dimension or parameter may shift the system's behavior. Consider difference along one dimension, such as liquid assets. In some circumstances, a difference in liquid assets among agents can generate new patterns of behavior. Minimal differences may result in little or no change, and extreme differences may result in cataclysmic change (bifurcation). A variation in the single value, however, can provide the impetus for a system to self-organize.

Complex systems are usually characterized by many dimensions. It takes more than one parameter to capture the state of the system at any point in time. Though there are many and various dimensions or parameters that might influence the behavior of the system, not all have equal influence. Product development, for example, may depend on team expertise, experience, funding, personal relationships, problem-solving styles, languages, and so on. Any one of these differences may be significant at one time and not at another. The most influential dimension(s) at any given time, in any given container, determines

the significant difference that will shape the path and product of the self-organizing process.

Agent attention or focus determines which dimension is significant at any moment and how difference along that dimension will affect the system. Many differences can exist in the system at one time and not be active in shaping the self-organizing process. Not all configurations of difference in a system generate coherent self-organizing processes. If the difference is too great along one dimension, then the system may bifurcate--split into two--because the container is not sufficiently resilient to hold the system together across it. If difference is apparent across too many dimensions, then the system dissipates energy trying to actualize too many potentials simultaneously. All strands of research in complexity either address or assume significant differences as central to the self-organizing process. Significant differences alone, however, are not sufficient for coherent self-organizing processes to progress. If the container is too constraining or not constraining enough, the differences in the system can dissipate. If the agents are inert, and are not able to connect with each other across the differences, then the potential energy represented by the difference will not be actualized.

Transforming Exchange

The agents in a complex adaptive system are semi-autonomous. Their interdependence, which is critical to their ability to self-organize into system-wide patterns, is called transforming exchange. Any transfer of information, energy, or material between two agents can function as an exchange and bind the parts of the system together into the whole. The exchange becomes transforming, however, when it affects the self-organizing

processes within the agent, crossing containers from the system of agents to the agent as a system. This transforming exchange appears in many complexity-related texts, including as "double interact" in the language of Weick (1979), "complex responsive process" in the language of Stacey (2001), or "strange loops" in the language of Cohen and Stewart (1994). In all cases, some transfer establishes the framework for a new system-wide pattern to self-organize. The transforming exchange is a necessary condition for self-organizing processes to occur. If the agents are not connected in a meaningful and transforming way, then the potential of the differences is not actualized, and the container gives way to other competing containers for self-organizing processes.

Language is the most obvious manner of transforming exchange between individuals, but many other transfers can serve the purpose, as well. Flow of funds, non-verbal signals, electrical or thermal connections are other examples of exchanges that can be transforming. In human systems, many different exchanges are taking place simultaneously, and each may contribute toward one or another pattern that emerges as the self-organizing process moves through time. Exchanges in a system vary in strength and in number. For the purposes of self-organization, many relatively weak exchanges can be more productive than a few very strong ones. In some cases, too many exchanges generate confusion, which can be viewed as noise in the system. The rates, paths, and products of self-organizing processes depend on both the number and the strength of the transforming exchanges. All strands of research in complexity either address or assume significant transforming exchange as central to the self-organizing process. Transforming exchanges, alone, however, are not sufficient for coherent self-organizing processes to progress. If the container is too constraining or not constraining enough, the exchanges

are random and patterns do not persist. If the differences are below or above the optimal thresholds (determined by the system state at a given time), then the transforming exchanges become redundant, and no new options for transformation present themselves.

Interaction of the Three Conditions

The three conditions are meta-variables for system definition. Each specific environment will include a set of variables that serve the functional role of each of the conditions. The containers, differences, and exchanges will be different in a supply chain, a firm, a team, a community, an industry, and individual psyche, and so on. For example, a team might work within the containers of membership, purpose, and temporal constraints of a schedule. The team's significant differences might include departmental association, levels of expertise, or professional vocabularies. The transforming exchanges for the team might include meeting agendas, minutes, and a final report. On the other hand, an organizational department might be contained by organizational boundaries; differences might include physical location and levels of responsibility; and exchanges might include memos, informal chat, or formal periodic reporting. The conditions will also be different from one time to another in any one of these domains, but every self-organizing system must have locally-determined characteristics that hold it together (container), establish a potential for change (significant differences), and transfer resources from one part of the system to another (transforming exchanges).

In addition to affecting the dynamics of the whole, each of the conditions affects the other two in unpredictable ways. Changes in the size of the system container, for example, influence the effectiveness of exchange relationships and the differences that make a

difference within the system. Likewise, a shift in significant differences as a system self-organizes can change the efficacy of the exchanges and put pressure on or renegotiate the system container. Finally, changes in the exchanges between or among agents creates the potential to discover new significant differences or to expand or contract the system's container.

The interdependencies among the three conditions are unpredictable because the meta-variables have nonlinear relationships to each other, but some patterns of dependence can be anticipated. Further research will be required to describe these complex interactions in detail, but the following relationships have been noted and appear in the instances involved in this study.

While each of the conditions shapes the self-organizing process, each is also shaped by the process as it progresses. As patterns emerge, they exaggerate or weaken the container, differences, or exchanges that are possible. These new conditions then affect the future iterations of the self-organizing process. In this way, the self-organizing process changes over time in a dynamical way.

A difference at one scale, within a system of focus, may function as a container at a lower level of organization. For example, differences among teams can influence the dynamics of a department. At the same time, each team functions as a container in which the individual team members' interactions shape the emerging patterns within the team. Conversely, a container at one level may function as a difference at a higher scale. A container is a particular difference that distinguishes one self-organizing system from another. Viewed from a larger scale, the same distinction functions as a difference within,

rather than a boundary around, a system of focus. For example, a statement of purpose of a team functions as a container for the dynamical interactions within the group. When considering multiple teams, however, their various purposes may function as differences that make a difference as the teams engage in coordinated or competitive activity with each other.

Transforming exchanges form the mechanism in some circumstances for magnet-like or affinity-like containers. The function of the container is to hold the system agents together as they interact to form system-wide patterns. In some cases, exchanges among the agents perform this function and serve to contain the system as a whole. For example, a network of email communications within a team supports transforming exchange, and it can also provide the mechanism by which the team members are held together as a whole system. Being "on the list" or "off the list" may describe the functional container for the team as it emerges.

In a single dimension, a transforming exchange will affect the system differently than exchanges between different dimensions. Difference in magnitude along a single dimension usually responds to simple and consistent exchanges between agents. For example, a difference in salary is negotiated through transactions related to compensation only. On the other hand, differences across dimensions usually require more complex and multiple exchange mechanisms. Within a team, for example, differences in professional standing, departmental association, gender, culture, and communication style all affect the team's dynamics. Multiple and complex exchanges are required to negotiate these diverse dimensions of difference effectively.

Because the conditions all affect the self-organizing process of the whole and also affect each other, each of the conditions can compensate in the process of self-organizing for the others. For example, a large container with low agent density may still be able to self-organize relatively quickly if the transforming exchanges are strong enough and/or if the significant differences are small. On the other hand, a large number of differences and weak exchanges may delay self-organizing processes, regardless of the size of the container. Generally, the size of the container and the differences threshold are inversely proportional to the strength and number of exchanges.

In the same way that physical systems move from potential to kinetic energy, complex adaptive systems move from disorder to order. Within a given container, differences of many dimensions among agents establish a tension. This tension is the potential for action and change. In a way, this tension stores potential energy of the system to organize. Exchange is the transformation of this potential energy into kinetic energy of the self-organizing process. The container limits the degrees of freedom of the system, providing the necessity of the system to reflect and amplify a small sub-set of possible behaviors. Without the container, there would be nothing to break the symmetry of random action of the agents.

Though the CDE Model is consistent with existing theory, it provides a novel and unique contribution to the field. First, it provides a description of what happens in self-organizing processes between initial and final states. Other approaches to self-organizing focus on the system states "before" and "after" but not about what happens in between to establish the path (sequence of events), speed, or outcome patterns of the process.

Second, the CDE Model provides a description that is sufficiently abstract to be generalizable. The meta-variables do not relate to the characteristics of a specific situation and its self-organizing process, but to the underlying relationships that shape the process, regardless of context. Third, existing theories focus on one or another of the conditions (container, difference, exchange) to the exclusion of others. For example, Stacey's "complex responsive processes" (2001) focus on exchange, attractor reconstruction (Guastello, 1995) focuses differences, patches (Kauffman, 1995) focuses on containers. The CDE Model, however brings all of these conditions into a single explanatory model.

The path of the self-organizing process depends on the massively entangled containers that exist between and among the system agents. Each of the intermediate patterns included in the path has self-organized, according to the same conditions that shape the whole. In the same ways that the container, differences, and exchanges shape the final pattern, they shape the intermediate ones as well. The sequence that moves from one self-organized pattern to another depends on the interactions of emergent patterns with each other. At each stage of development, the container is expanded to include a larger proportion of the system, relevant differences are those between emergent patterns rather than between individual agents, and critical exchanges are between agent clusters rather than between individual agents.

The speed of the self-organizing process is shaped by the three conditions as well. A larger or more ambiguous container reduces the probability that individual agents or emerging local patterns will engage with each other, so it takes more time to accumulate

the threshold number of interactions that might lead to new patterns. Larger magnitude or greater number of differences reduces the speed of self-organizing, as well. Large differences require a higher level of interaction to be resolved into system-wide patterns. A large number of relevant differences increase the variety of intermediate patterns that are established and complicate the interactions between and among the emerging, local patterns. Finally, weak exchange relationships among agents have limited effectiveness, so more exchanges are required to establish the new pattern. Because each exchange takes place in time, the total time of the self-organizing process is extended. On the other hand, small and clear containers, minimal magnitude and number of differences, and tight exchange relationships speed up the self-organizing processes.

The product of the self-organizing process is a stable, system-wide pattern. The nature of the pattern depends on its scope (container), its internal structure (difference), and the final state of the relationships among the agents (exchange).

Self-Organizing and the CDE Model

Container, difference, and exchange are the conditions that shape the path of the self-organizing processes. Self-organizing is the process that moves from one state of coherence to another. It begins with one situation of the system-wide patterns and ends with another. Other models, described above, discuss the initial and final states of the self-organizing system. By considering the interactions (exchanges), other models confirm that "something" is happening, but the exchanges themselves are not sufficient to generate a system-wide pattern in the course of the process. There must be something at the system level that influences the exchange among individual agents, otherwise the

exchanges are merely isolated incidents. The path, speed, and resulting patterns of the self-organizing process depend on the context of the system as a whole. Containers, differences, and exchanges are the meta-variables in the context that influence individual exchanges to form system-wide patterns over time. The path, speed, and outcomes of the self-organizing process are shaped by the system containers, differences, and exchanges, so they constitute the "conditions" for self-organizing.

The three conditions are necessary to self-organizing because any system that exists in reality has all three, though the patterns that emerge may not be efficient or considered effective. What would happen if you had a collection of agents that did not exchange any information, material, or energy? Regardless of the boundary around them or their individual characteristics, they would not generate system-wide patterns. What would happen if you had a collection of agents that exchanged information, material or energy inside a boundary, but all the agents were identical? No new system-wide patterns would emerge. What if you had agents with different characteristics that exchanged information, but there was no condition that held them together over time? No system-wide patterns would develop. In the absence of any one of the conditions, the self-organizing process would not generate new system-wide patterns, so all three of the conditions must be necessary to the self-organizing process.

A practical example will illustrate the necessity of the three conditions for self-organizing. Imagine a team of ten people. If they don't talk to each other or engage each other in any way, would they come to common action? No. If they don't focus on the same thing (magnet), have anything in common (affinity), or operate in the same vicinity

(fence), would they come to common action? No. If they are identical to each other, no significant differences, would they generate new common action? No. Without all three of the conditions for self-organizing, the team of ten would be unable to establish a foundation for shared understanding or action.

The CDE Model is also sufficient to shape the path, speed, and outcomes of the self-organizing process. All of the critical factors that are present and shape the behavior in the self-organizing process of human systems function as one or another of the conditions. All factors either establish a system boundary (container), support transfer of information, material, or energy (exchange), or articulate tensions in the system (difference).

A traditional T-Group is one living example of both the necessity and sufficiency of the three conditions. The T-Group is an individual change mechanism and an organization development intervention that is used extensively by NTL practitioners. In a T-Group, a group of individuals is brought together without agenda, leader, or explicit common purpose. In the course of the group interactions, all members learn how to give and receive feedback and to observe their effect on a group and the group's effect on them as individuals. The T-Group establishes a container by having clear membership and by enclosing all members in a seated circle, and setting time limits for the interactions. Within this container, differences and exchanges generate patterns of group behavior. Sometimes the behavior is stable and coherent; sometimes patterns are neither stable nor coherent. By practice, T-Group practitioners have developed procedures for establishing the conditions for productive group interaction. Though they have not articulated

hypotheses about the conditions for self-organizing, the practice consistently includes characteristics of container, difference, and exchange.

The CDE Model describes the three meta-variables that shape the speed, path, and outcomes of the self-organizing process in human systems. Each of the conditions can be observed separately, though the nonlinear interactions among the conditions and the dynamical evolution of the system as a whole requires that all three influence and are influenced by the other meta-variables and by the emergent patterns in the self-organizing system.

Summary

In this chapter the research in the applications of complexity theory to self-organizing human systems has been presented and the need for a coherent model that will integrate the many strands of related research has been outlined. Critical incidents in both theory and practice that led to an integrated model for the conditions of self-organizing were described, and the CDE Model for the conditions of self-organizing in human systems has been suggested and articulated. The study, described in the following pages, investigates the CDE Model as it was used to assess, intervene in, and evaluate the interventions in eighteen instances of organization development activity.

CHAPTER III: METHOD

Research in Complex Adaptive Systems

Traditional social science research methods depend on a variety of assumptions about the nature of change and the nature of evidence. Many of those assumptions are not accurate in systems involving humans and their complex relationships. Complex adaptive systems share a variety of characteristics that make standard research and data analysis methods ineffective. Six of these characteristics and their effects on research methods are described below: Nonlinear causality; high dimensionality; dependence on context; discontinuity; sensitive dependence on initial conditions; and massively entangled levels.

Complex adaptive systems involve nonlinear causality. Most research methods assume that a small number of variables determine the behavior of the system; that some of those variables are dependent and others are independent; and that there is minimal interdependency between any two variables. Essentially, the expectation is that variables in the system can be separated and controlled (Miller, 1991).

The nature of a complex adaptive system defies these assumptions. Though a small number of parameters, or driving variables, can be identified in many complex adaptive systems, these variables work in nonlinear relationships to each other. A small change in either variable results in a change of unpredictable magnitude in the other, so neither of the variables can be reliably controlled or be seen to have an independent relationship to the system-wide behavior. Take the example of a basketball team's game plan.

The plan might involve controlling a single member of the opposing team. This strategy causes the opponents to depend on other players. Over time, the initial strategies must shift to adapt to the opposing strategies.

Complex adaptive systems include many different relevant variables, so they are described as high dimension systems. Human complex systems can be understood in terms of a large number of inter-related variables. Each variable could form a viable dimension of analysis. Over time, in the dynamical evolution of a system, one or another of the dimensions can increase in relevance to the behavior of the group. For example, team member height may determine the success of a basketball team in terms of its ability to rebound, while speed or size may be more relevant in other defensive situations. The primacy of individual parameters depends, to a great degree, on the context.

Complex adaptive systems are intimately related to their environments. In traditional research methods, it is expected that a system of focus can be isolated from its context (Miller, 1991) or that the contextual influences can be controlled over time. A complex adaptive system, on the other hand, depends on changes in the context as much as on changes that are arbitrarily considered a part of the system's internal dynamics. Again, the basketball team provides an example. In the course of the game, the salaries of the individual players may seem to be irrelevant, but the "trash talk" between players may introduce this variable into the game's dynamics and shift the interactions in critical ways.

Complex adaptive systems exhibit discontinuous change. The assumption has been made successfully in most physical systems that initial and final states of the system provide

information from which conclusions can be drawn about the intervening states of the system. In simple, linear systems this assumption holds true, but it is not reliable when systems experience discontinuous change. Complex systems frequently exhibit discontinuous behaviors. The phenomenon of punctuated equilibrium (Bak, 1996) is relatively common in systems as they interact dynamically. One player may make all shots early in a game and spontaneously "lose the touch" as the game progresses. His or her half-time statistics may be quite different from those at the game's end.

Complex adaptive system behavior is extremely sensitive to initial conditions. All chaotic systems are sensitive to initial conditions. That means that a small difference between samples early in the life of an experiment may be amplified over time, until the differences between the samples is quite great. This, coupled with the high dimensionality and context dependence of the complex adaptive system, make predictability nearly impossible. To return to the basketball analogy, a small difference in the jumping height during a tip-off may shape the outcome of the game--or not. One of the complications of sensitive dependence is that the observer has no way to know ahead of time which small differences will be amplified and which will be damped by later system interactions.

Complex adaptive systems involve multiple levels of structuration. Each level has its own relevant variables and internal dynamics. Patterns can be repeated across levels to provide scaling and whole-system coherence (Eoyang & Berkas, 1999), but distinct sets of indicators appear at each level. The part and the whole influence each other, but each demonstrates its dynamics with unique indicators. To understand the complex system, the

researcher must collect and report data at multiple, massively entangled levels. The team's history is measured by wins and losses over a period of years. This is different from, but related to, the statistics that describe individual players' performance during a single game.

Various research methods have been derived to respond to the nonlinear interdependence of variables and other special characteristics of complex adaptive systems. Methods such as content analysis and grounded theory (Patton, 1990) have emerged to help researchers investigate systems when system-wide patterns are the focus of the investigation, and separable variables have not been (or cannot be) identified. Case study methods have been used frequently to assess the self-organizing patterns retrospectively. These methods articulate emergent patterns, but theory testing is difficult and generalizability of such studies is limited.

Time series analysis is a quantitative approach to studying complex systems (Poole, et al., 2000; Guastello, 1995). It has proven to be a valuable research method when longitudinal data are available for analysis and when the emergent attractors are of sufficiently low dimension to allow for reliable models to be defined. These methods are not effective when long-term data are not available or when the system involves too many relevant dimensions to model with existing techniques.

Computer simulation models have also served a purpose as a research method for complex systems (Kauffman, 1995). These models are primarily deductive in their designs. Researchers posit simple rules or small numbers of nonlinear variables, then build computer simulations based on those assumptions. The resulting system behaviors

are compared and contrasted to observed behaviors in organizations and groups. The limitation of these models is that they do not account for the unique contexts of the systems *in situ*, so the correlation with reality is usually tenuous and hypothetical.

Limitations of these methods preclude them from application in the current study for a variety of reasons. Long-term, quantitative data are not available, so time series modeling is not feasible. A detailed case study would reveal the dynamics of a single case, but it would not allow investigation of the model over a variety of organizational levels, types, or environments. The study must be inductive in nature to investigate the model's descriptive power in real situations, so a computer simulation model based on deductive logic would not be appropriate. For these reasons, another research approach, the Results Reversal Method, will be used in the study.

Results Reversal

Cohen (2000) has articulated an alternative method for testing hypotheses related to the behavior and mechanics of complex adaptive systems. The method, which he calls "Results Reversal," uses a common-sense approach to testing hypotheses in living systems. Cohen and his students have used this Results Reversal Method in a variety of biological and chemical systems. He describes the method this way:

This is what result reversal is about: if you can show that removing A prevents X, and that replacing A regenerates X, then this is a much more convincing demonstration of causality than lack of A preventing X.

However, even on its own the second half (restoring function) is more convincing of causality than the first step, because there are so many more ways to lose function than there are to regain it (pp. 77-78).

The principle is a simple and practical one. If a system is not working, and you have a hypothesis about why it is not working, you can design an intervention based on the hypothesis. If the system improves, then the hypothesis about the cause of the problem is supported. If the system fails to improve, then the hypothesis is not supported. The support of the hypothesis is held, even though many other unpredictable factors may influence the outcome.

This is a pragmatic problem solving approach used by technicians in many different industries. My computer stops working, and I think it might be a virus. I run the virus protection software. If that intervention returns the computer to its prior function, then I

can be relatively sure that the virus was the cause of the initial problem. This method seems particularly suited to the current study for a variety of reasons. The systems under investigation are complex, including a large number of uncontrollable and nonlinear variables. All of the systems are reliant on their contexts for full functions, but the contexts for the systems are widely varied. The hypotheses involve process and causal mechanisms in which the effects of changing one or another of the conditions for self-organizing can be observed and documented.

Results Reversal can be described as a myopic search technique because it selects hypotheses to test on a localized circumstance or situation. In many experimental environments this approach is not appropriate, but it is imminently suitable to the variable and context-sensitive situations of organizational intervention. In any organizational intervention, there will not be a single successful outcome. Rather, an unpredictable number of solutions might be equivalently successful. In a situation where many alternatives might prove acceptable, a myopic search technique, such as Results Reversal, will provide meaningful and satisfactory results.

In the current study, the CDE Model is used to describe the current patterns in the system and to propose an intervention that will shift the pattern toward greater coherence and resolution of the presenting problem. Implementation of the CDE-based intervention and subsequent evaluation of the system status allow the researcher to determine the reliability of the CDE Model to describe and propose interventions that lead to new patterns of interaction and desired outcomes for system performance and coherence.

Design of the Study

The study is designed to investigate the following hypotheses:

H₁: Interventions that change one or more of the conditions for self-organizing (container, difference, exchange) change the coherence of the system.

H₂: Interventions that increase the coherence of one level of the human system increase the effectiveness of that organizational level.

An *intervention* is any intentional activity designed and implemented to respond to an organizational problem identified by the client. Examples from the study include large-scale interventions, training, and facilitation of group sessions.

Conditions for self-organizing are meta-variables that affect the rate, path, and outcomes of the self-organizing process in a human system.

Container is any bounding condition that distinguishes a system from its environment. It is one of three conditions for self-organizing in human systems.

Difference is a distinction within a system that establishes a potentially generative tension, which represents the potential for change. It is one of three conditions for self-organizing in human systems.

Exchange is the transfer of information, resources, or energy between or among system agents that results in changes within the agents and/or in system-wide patterns. It is one of three conditions for self-organizing in human systems.

Coherence is 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.

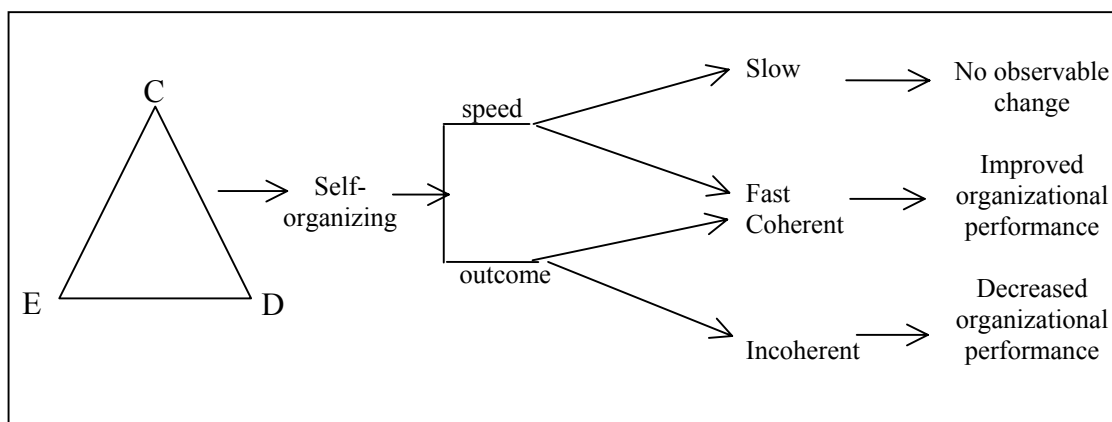
Organizational level describes the hierarchy of organizational structure within a human organization. For the purposes of this study, the following organizational levels are addressed: Concept, team, institution, community. The conceptual level involves development of mental models as they are held and/or documented by individuals or

groups of individuals working together. The level of the team is defined as a group of persons working together within an institution toward a shared purpose or common task. Sometimes teams are established by formal or permanent processes, and sometimes they are informal or temporary. The institutional level is defined as a functional organizational or business unit. Institutions included in the study are for-profit, not-for-profit, governmental, and religious institutions. Community, as a level of organizational structure, involves a variety of individuals or institutions that come together to solve common problems across institutional lines.

Effectiveness is defined, for the purposes of this study, in terms of the clients' statement of a presenting problem. An effective intervention resolves the stated issue or concern of the client.

The two hypotheses of the study involve both the process of self-organizing and the effectiveness of the outcome of the self-organizing process. The figure below outlines the causal model on which the two hypotheses are based.

Figure 2. Self-Organizing and Organizational Effectiveness



Hypothesis 1 deals with the initial stages of the model in which the conditions set the stage for self-organizing and the speed and outcomes of the self-organizing process. The relationships among the three conditions, the process of self-organizing, and the speed and coherence of the emerging pattern are nonlinear and complex. This process works in a rugged landscape, where multiple outcomes are possible, and the nonlinear interactions of the agents in the system result in unpredictable emergence of system-wide patterns.

Hypothesis 2 focuses on the relationship between the emergent patterns and performance of the organizational system. This stage of the process is also nonlinear and dependent on context, including the expectations of the client and the interdependence of the massively entangled self-organizing processes that influence the system of focus. The relationship between coherence and organizational performance, however, is more causal in nature than the self-organizing process itself because it involves fewer degrees of freedom and clearer causal relationships.

The study is designed to investigate both of these interdependent processes. It describes each of eighteen organizational problems from the client's perspective, analyzes the prior conditions for self-organizing, hypothesizes an intervention to shift one or another of the conditions, and describes the outcome in terms of the client's expectations and the coherence of the resulting system state.

Based on the client's expectations, a hypothesis was formed to define the level of organizational intervention and to describe the current self-organized state of the system in terms of existing containers, differences, and exchanges. This hypothesis articulated the one or more conditions as a focus for intervention in the instance. Selection of the

condition of focus was determined by two factors. Which condition was most closely related to the current issues of concern to the client? Which condition would be easiest to influence, given the constraints put on the project by clients and their environments?

When the condition of focus had been identified, the intervention was designed to shift the condition and influence the self-organizing patterns of the group. In some instances, the intervention included multiple activities, and in other cases a single activity was included. Following the intervention, the outcomes were assessed in terms of the client's expectations and the emergence of changed coherence either at the scale of focus or at levels below or above it.

The presenting problem as described by the client was restated, based on the presence, absence, or relative strength of the conditions for self-organizing prior to the intervention. The intervention was designed to influence the conditions of the CDE Model. The CDE interventions were performed, and the outcomes were evaluated in terms of the clients' expectations and the resulting status of the three conditions and coherence of the system-wide patterns.

In each instance, the desire of the client was to help the human system work better as a whole. The goal was to improve the ways in which the parts of the system functioned together. This characteristic, labeled coherence, was assessed in each of the instances, based on reports from participants involved in the process and the client who had stated the original presenting problem. Based on this data, the researcher reported whether or not coherence of the system under investigation increased in coherence.

Sample

The study includes eighteen situations in which organization development interventions were implemented by the researcher between 1994 and 2001. The interventions lasted between one day and several months. In some cases, the engagement with the client began before or continued after the intervention studied. The researcher either worked alone or in collaboration with other professionals. In many of the interventions, the researcher worked closely with a colleague who was a permanent member of the client organization or team.

The sample includes four non-profit corporations (two interventions were in the same organization), three for-profit companies (one each in retail, high tech, and financial services), two religious organizations, three informal or unincorporated groups, and five governmental entities.

The instances presented also represent multiple levels of system focus. Two involve conceptual coherence, in which the goal was to bring together disparate ideas into internally consistent models or products. Six focus on teams, with the goal of increasing the working coherence and effectiveness of a small group of individuals. Eight instances involve problem statements and intervention designs to improve coherence within formal, permanent institutions. The remaining two instances describe efforts to increase coherence across a community that includes multiple institutions or individuals who have no formal or permanent organizational relationships.

Intervention Designs

The design of the intervention in each instance is based on analysis of the presenting system-wide patterns in terms of the meta-variables of the CDE Model. A unique model of the containers, differences, and exchanges that shape the patterns at the initiation of the project are described, and an hypothesis is stated regarding which of the meta-variables should be shifted by the project's intervention. An organizational intervention is designed to shift the selected meta-variable (container, difference, or exchange), and the intervention is implemented. Later evaluation of the system patterns determines if the intervention, based on the CDE Model hypotheses, was successful.

Each situation involves a unique intervention, designed to meet the needs of the client and the system status. In addition to the CDE Model analysis, factors that influenced the selection and design of interventions included the client's conceptualization of the problem, budget and time availability, the facilitator's experience with and preference for various intervention techniques, number of participants, and geographical distribution of participants. Each intervention was designed and implemented in cooperation with representatives of the client organization.

Various interventions were used in the course of the study, including retreat settings (five), meeting design (two), meeting facilitation (two). Other interventions were used only in single situations, including case study, work product, organizational redesign, Future Search, training, process redesign. Three situations involved multiple processes implemented over a period of time.

In some of the interventions, the CDE Model was shared explicitly with the client and participants in the change process. In others, the researcher used the model to assess, design, and implement interventions, but the model was not explicitly shared with participants.

In one instance (Instance 6: Health Care Think Tank) the researcher was a participant in and observer of the system rather than an organizational consultant or practitioner. This instance was included in the study because it involved a unique situation in which individual agents came together across widely diverse professional, geographical, and organizational lines to work together toward a common goal.

Each of the interventions was executed in the midst of a complicated and emergent environment. During the design and implementation of each intervention, changes in other parts of the organization and at other levels of the hierarchy influenced the emergent patterns within the system of focus. These complex interdependencies might be seen as contamination of the study, or they can be understood as further examples of the self-organizing process at work in the micro- or macro-systems outside the scope of the study. In some instances, exogenous system emergence (at conceptual, team, organizational, or community scales that were not the focus of the study) was seen as relevant to the system of focus, and those dynamics are included in the analysis. In other instances, the emergent dynamics were not observed to influence the sample directly, and they are not included in the findings of the study.

Data Collection

Data was collected throughout the engagement with the client system. The process included initial contacts with the client and interviews with key stakeholders that led to a preliminary hypotheses about the current situation, analysis in terms of the CDE Model, selection of conditions for intervention, and a draft of the intervention design. The intervention design documents were reviewed by the client and revised to meet contractual expectations. Based on the design, materials were developed to support the intervention. Support materials varied from instance to instance, but they included handouts, background information, and/or presentation slides that were used during the intervention contacts. Notes collected from the group during the session(s) were collected and documented for later review by the client and participants. Most sessions were evaluated by participants, and those findings were included in the case files.

Case notes were kept on all situations, including proposals for interventions, agendas and other meeting support materials, evaluations of retreat and training sessions, minutes of meetings, and other documents that were created in the course of the intervention. These case files provided the data on which the instance descriptions and analyses were based.

Data Analysis

The process of analysis was the same for all instances, regardless of the type of organization or the level of intervention. The presenting problem was stated from the client's point of view. Following the intervention, client comments, participant reactions, and subsequent activities of the individuals or groups involved were reviewed to

determine whether or not the intervention had been successful in meeting the client's expectations for improved coherence and performance.

In all cases, the desire of the client can be described as increasing coherence. 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, and parts of the system function in complementary ways. The stated desire of the client in each instance was to establish a coherent group to plan or implement coordinated action.

Using the Results Reversal Method, the hypotheses regarding the conditions for self-organizing and their relationships to organizational effectiveness and coherence were investigated. If the outcomes of the interventions indicated changed coherence and/or resolution of the client's presenting problem, then the hypothesis regarding the conditions for self-organizing based on the CDE Model was judged to be acceptable. If, on the other hand, the outcomes did not increase coherence of the system and/or meet the client's expectations, then the hypothesis was judged to be insufficient.

Ethical Treatment of Human Subjects

The study involves retrospective analysis of eighteen instances of interventions in organizations. Primary relationships between the researcher and the client organizations were professional, focusing on the current situations and recognized issues in the organizations involved. For this reason, no effort was made at the time of project initiation to obtain informed consent from individuals or organizations for participation in the research efforts that emerged later.

In accordance with Union Institute and University policy, the Doctoral Committee serves as the Internal Review Board for the Ethical Treatment of Human Subjects. The Committee approved the following plan to ensure protection of the subjects involved in the research:

- Instance descriptions do not include names of organizations or individuals involved in the study.
- Organizations and individuals were contacted, informed of the study, and provided with the instance descriptions that are included in the study.
- Only the instances involving participants who did not decline to be included in the study were incorporated in the study.
- A subject's decision to join or to be excluded from the study had no effect on its personal or professional relationship with the researcher.

The Internal Review Board and the researcher confirm that this procedure adequately protects the human subjects whose activities and situations are included in the study.

CHAPTER IV: FINDINGS

Introduction

The study was designed to investigate the following hypotheses:

H₁: Interventions that change one or more of the conditions for self-organization (container, difference, exchange) change the coherence of the system.

H₂: Interventions that increase the coherence of one level of the human system increase the effectiveness of that organizational level.

The instances included in the study focus on specific presenting problems and specific interventions to respond to those problems. Of course each of the consulting relationships between the researcher and the client organizations involved many rich and varied experiences over an extended period of time. Dynamic changes and interactions at scales above and below that of the presenting problem were present in every one of the instances described on the following pages. In depth and detailed descriptions of the situations, though interesting, are not included as part of the data because they are not relevant to the current study for three reasons.

First, the hypotheses to be investigated involve high-level questions about the efficacy of application of the CDE Model in affecting the coherence of the system and about the relationships between coherence and organizational effectiveness as defined by the client's presenting problem. These questions focus on gross characteristics of the instances described.

Second, the conditions for self-organizing at any one scale or part of the system are intimately connected with those at other scales or parts. Because of this intimate and complex interaction, dynamics external to the focal system are implicitly portrayed in the containers, differences, and exchanges that are directly relevant to the instance and its presenting problem.

Third, the intent of the study is to investigate the generalizability of the CDE Model, rather than to delve into the implications of the model for a single case study. A large number of instances were included in the study to address the question of generalizability. The large number of cases made it unrealistic to include detailed descriptions of any of the individual situations.

For all of these reasons, the instance descriptions that follow are abbreviated and focus on the questions related directly to the hypotheses: What was the background that initiated the intervention? What were the initial conditions for self-organizing? What was the intervention as designed and implemented? What was the outcome of the intervention(s) in terms of change in coherence of the system and resolution of the presenting problem?

This section of the study provides brief descriptions of the eighteen instances when the CDE Model was used to assess an organization's needs, design and implement interventions, and evaluate outcomes. The initial state, intervention, and final state of each of the organizations are summarized in Tables 1 and 2.

Instances of Self-Organizing in Groups

This section describes eighteen instances of self-organization in groups. Each instance includes a narrative history of the group, an analysis of the conditions for self-organization, and observations about the conditions and self-organizing patterns of the group. The instances of clients and their companies described herein include:

1. Research and Service Institute
2. Strategic Planning Study Group
3. International Religious Membership Organization
4. Inter-Governmental Think Tank
5. Financial Services
6. Health Care Think Tank
7. Restorative Justice
8. County Library
9. Environmental Training
10. Study Group
11. Regional Office of Religious Organization
12. Retail Creative Services
13. International Mortgage Servicing
14. Research and Service Institute--Organizational Learning
15. County Social Services
16. Liberal Arts College

17. Whole System Service Delivery
18. Inter-governmental Health Care Planning

The table following the descriptions summarizes the findings. The descriptions of the instances appear below.

Instance 1: Research and Service Institute

<i>Instance 1: Research and Service Institute--Evaluation</i>	
Organization type:	Non-profit
Date:	1998-99
Presenting problem:	Ineffective support by the organization for clients' design and implementation of evaluation systems.
Domain:	Concept
Hypothesis:	Differences were clear, but exchange was unfocused. A work product (training and documentation) will form a new container to support client action and satisfaction.
Condition:	Container
Intervention:	Work product: Article and training guide
Outcome:	Included: <ul style="list-style-type: none"> • Individual learning for writers and clients • Contribution to the field of program evaluation • Improved client performance and satisfaction
Changed coherence Resolved presenting problem:	Yes

Background. A social service research and consulting non-profit corporation publishes their findings on youth and community development and provides support to communities wishing to implement programs based on their research. One of their senior scientists specializes in program evaluation. He faced the challenge of designing effective evaluations for implementation of programs in diverse communities, each of which received a different level of support from the organization during implementation. The environment satisfied few if any of the underlying assumptions required to perform traditional, rigorous program evaluations.

In an effort to establish standards for program evaluation among for clients, the scientist began investigating the properties of complex adaptive systems. His research led him to perceive that evaluation design must be quite different for open, self-organizing systems like those of the organization's client communities.

Conditions for Self-Organizing. The container for his work was a conceptual one--program evaluation. The primary difference he sought to investigate was between evaluation of pre-designed and emergent programs. The exchange under consideration was the evaluation process itself and the communication in technical support and training for client communities.

Intervention. Working within this frame, the scientist redefined the scope of the program evaluation process to encompass the complex adaptive as well as the predictable aspects of the system's behavior. He identified guidelines and criteria for evaluation in communities as complex adaptive systems. He co-authored a paper on the subject, and taught clients to apply aspects of the CAS Model to their local evaluation efforts. These innovative options for CAS evaluation were neither accepted or implemented by others in the organization. His colleagues, both scientists and consultants, thought that the differences between their client systems and traditional program implementations were not significant, so they saw no need for the novel CAS approach. The differences the paper amplified were not acknowledged as significant differences within the organization.

Outcome. Two products emerged from the intervention efforts. A paper was presented at an international research conference and published (Eoyang & Berkas, 1999). The

conceptual coherence of the paper, and the differences described in the paper, moved out of the organizational container of the single organization and into the larger container of academic and professional interest in program evaluation. In this larger container, the distinctions between CAS and traditional systems evaluation processes were significant.

Training materials based on the findings were published and distributed to clients by the Institute. Clients expressed demand for the materials and the training and reported high levels of satisfaction with both.

The work products (research paper and training materials) provided a clear and focused container for the investigation. In both of these products, the coherence of the concepts was improved.

The domain of this instance is defined as conceptual, which is different in many ways from the other three domains--team, institution, and community. Because the objective was to establish a coherence in concept, the fact that the coherent conceptual construct persisted in professional conversations and products outside of the organization, rather than in the organization, does not affect the success of the intervention or the efficacy of the outcome.

Instance 2: Strategic Planning Study Group

<i>Instance 2: Strategic Planning Study Group</i>	
Organization type:	Informal
Date:	1998-2001
Presenting problem:	Shared interest in a theoretical problem was insufficient to bring a group to consensus.
Domain:	Concept
Hypothesis:	Exchanges were rich and differences were clear, but the ambiguous container for the work led to minimal progress. Focus on a specific case will form a container that will improve the coherence of the project activities.
Condition:	Container
Intervention:	Case study: Focus on applications to a particular situation
Outcome:	<ul style="list-style-type: none"> • Individual learning about CAS and organizations. • Process for CAS-based policy planning designed and implemented.
Changed coherence Resolved presenting problem:	Yes

Background. In February of 1998, three consultants began meeting and studying together on a regular basis. Their goal was to define a new process for public policy decision making. Their experience was that the linear, traditional model of analysis and decision making failed to capture the rich interactions of reality. They sought a model to define a process that more closely described the reality they all experienced while working in the public sector.

Conditions for Self-Organizing. Initially, the idea of a CAS-based planning process served as a container for the group. Differences within the group were based on education and experience. One, trained as an anthropologist, was working as a policy analyst for an urban county. One, trained in classical physics and philosophy, worked as a consultant supporting organizations in applications of complexity theory. The third, trained as an economist, worked as an economic forecaster in a regional planning organization. He left that position later in the project and became an independent planning consultant. Each of the co-researchers shared an interest in complexity and a passion for improving public policy decision making. Their diverse backgrounds, however, introduced significant differences in language, referents, and explanatory models. Their bi-weekly meetings and written notes from those meetings provided the exchanges that set the final condition for self-organization of the emerging conceptual models and understanding.

Usually the individual conversations self-organized into coherent wholes. Individually, the researchers reported significant learning and personal growth. For some time, these levels of emergence were sufficiently satisfying for the group. After a time, however, each one expressed a desire to broaden the scope of the learning and to enrich the self-organizing process.

Intervention. In mid-1999, the group had an opportunity to work with a client organization. The organization would become a source for developing the emerging theory and testing that theory in a real public policy setting. This definition of the system container introduced a variety of concrete differences into the conversations of the group. These differences--political, economic, power, personal, historical--informed the work of

the group and established a new and more productive line of inquiry. The group continued to talk about theory and business possibilities, but the grounding of the conversations in a real-world example made learnings more explicit and, therefore, more useful and coherent.

In addition to providing more, and more concrete, differences to enrich the conversation, work with the client introduced the requirement that the group establish exchanges beyond their own circle. To communicate effectively with clients, the three consultants were forced to translate their work into metaphors and models that would be understood by others. This challenge accelerated the self-organizing process of the group as well.

Outcome. The group continues its conversation, working on individual learning, group insights, and practical applications to real organizational cases. A complexity-based change model is being implemented in the client organization with good results. The focus on the specific case project continues to bring productive coherence to the work.

Instance 3: International Religious Membership Organization

<i>Instance 3: International Religious Membership Organization</i>	
Organization type:	Religious
Date:	1994-1998
Presenting problem:	Task force focused on internal conflicts, rather than reaching stated objective: to establish new vision, mission, and structure for the organization as a whole.
Domain:	Team
Hypothesis:	Difference in Task Force reflected those in the larger organization, but they could not be resolved within the existing (Task Force) container. New exchanges would resolve tensions and allow for whole-system learning and change.
Condition:	Exchange
Intervention:	Facilitation: <ul style="list-style-type: none"> • Establishing exchanges between the Task Force and the rest of the organization. • Improving exchanges during Task Force meetings.
Outcome:	Included: <ul style="list-style-type: none"> • Consensus was reached within the Task Force on recommendations for the organization as a whole. • Organization accepted recommendations from Task Force.
Changed coherence Resolved presenting problem:	Yes

Background. A world-wide Protestant denomination of eight million members established a Task Force to articulate the new vision, mission, and structure for the church in the new century. In mid-1994, the group's process was interrupted by a variety

of political issues. As part of the project re-design, the team decided to incorporate CAS into their data analysis and process design activities.

Conditions for Self-Organizing. At that time, the Task Force was the primary container within which project work was developing. Differences within the Task Force mirrored those in the organization at large: lay/clergy, liberal/conservative theologies and social justice models, local church/general church, and North American/global contexts.

Exchange patterns within the group were formal (highly controlled quarterly meetings) and informal (personal networks among like-minded individuals).

Intervention. Rather than focusing on resolving the differences within the group, the intervention established exchanges between the group and the rest of the church community. The Task Force adopted an iterative process plan that included listening, reflecting, and recommending. Through large and small meetings and surveys, the group listened to the concerns and needs of various interest groups across the church. With facilitated support for their periodic meetings, the Task Force reflected on the findings, and prepared recommendations that were shared with others in subsequent listening sessions.

Outcome. The draft Task Force report was ready for distribution approximately six months before the deadline in 1996. The report was shared with many different groups, so the Task Force had ample time to listen, reflect, and recommend again before distributing their final report. The report, which recommended a new organizational structure for local churches around the world, was accepted by the church's legislative body and was incorporated into the governing documents of the organization.

The coherence of the team improved when their focus shifted to collecting and analyzing information from the larger organization. This focused the group, as a whole, on a shared activity and role and allowed them to work together without focusing on their internal differences.

Instance 4: Inter-Governmental Think Tank

<i>Instance 4: Inter-Governmental Think Tank</i>	
Organization type:	Governmental
Date:	1997
Presenting problem:	Build new energy in a diverse and sometimes contentious group.
Domain:	Team
Hypothesis:	Significant and generative differences within the group were not addressed because exchange processes were ineffective. No shared container held the group together. A temporary design that established container, exchange, and differences will allow the group to build a mission and vision for the future.
Condition:	Container, exchange, difference
Intervention:	Future Search to: <ul style="list-style-type: none"> • Establish a coherent, though temporary, container • Articulate the significant differences • Support transforming exchange among members
Outcome:	The group identified a new vision and established work groups to implement its vision.
Changed coherence Resolved presenting problem:	Yes

Background. A group of experts from a state department and multiple counties had met together for many years. The group was established by the State Department of Human Services (DHS) in hopes that improved communication would increase county cooperation and appreciation of services provided by the state-wide computer information systems. Participants represented either human service delivery program

areas or information technology groups. The group was established to address the traditional conflicts between counties and the state in the use of technology in delivery of human services. Initially, the group met primarily to share information about current projects and to seek buy-in from county personnel on projects that were designed and managed by the state. In the course of the intervention, that goal was changed by the group.

Conditions for Self-Organizing. The container that held the work of the group was the commitment to the use of technology in human service delivery. Membership was open to any person who chose to attend the monthly meetings. Differences among the participants were obvious: state/county, information/human service professionals, metropolitan counties/rural counties, experienced/novice users of technology. These differences might have enriched the conversations of the group, but fundamental perceptions of power difference between functional and organizational subgroups distorted the conversation. Many meetings reinforced a sense of distrust of the power held across these differences. Exchange patterns during the monthly meetings included the state reporting and explaining project decisions, and the counties reporting problems and troubleshooting decisions.

Intervention. In 1997, the group was losing momentum and focus. Co-chairs of the group--one from DHS and the other from a large urban county--decided it was time to re-energize the group. In consultation with an organization development professional, the co-chairs decided to sponsor a Future Search to establish a new vision and a sense of shared purpose among the membership.

The Future Search (Bunker & Alban, 1996) was a temporary small container to focus the energy of the group on future possibilities, rather than current realities, established transforming exchanges, and articulated underlying differences among members. As a result of the Future Search, the group created a new vision for technological delivery of human services, a new name, and a metaphor for emergent change (Tacking to the Mark). They also established working groups to focus on specific issues.

Outcome. The vision and mission that self-organized during the Future Search have continued to serve the organization well. This foundation has framed a variety of technical and organizational questions that shape the programs at monthly meetings. The statement has also helped shape the specific project work at state and county levels. Multiple projects are progressing state-wide, some in partnerships and joint ventures, to implement the shared vision for the integration of human services through the use of technology that emerged during the Future Search.

The improved coherence of the group was manifested in three ways: Attendance became more consistent and stable, the vision statement was published in a brochure that supported external communications about the group, participating organizations at the state and county levels initiated projects to implement aspects of the vision for the uses of technology to support the delivery of human services.

Instance 5: Financial Services

<i>Instance 5: Financial Services</i>	
Organization type:	Business
Date:	1998
Presenting problem:	Supervisors and managers lack leadership skills.
Domain:	Team
Hypothesis:	In an organization with minimal exchange and extreme perceived differences between departments and organizational levels, training in complex systems thinking will improve managerial effectiveness.
Condition:	Exchange
Intervention:	Training: Design and pilot training for middle managers in systems thinking and complex adaptive systems design.
Outcome:	CAS training was rejected in favor of training on interpersonal skills for managers.
Changed coherence Resolved presenting problem:	No

Background. A division of a global financial services firm recognized the need to improve the leadership competencies of its middle managers. Though the organization was viewed as a progressive and successful company, the operations and information systems groups were not able to move quickly and flexibly enough to respond to the emerging needs of the global marketplace. The human resources department established a cross-functional, interdepartmental Planning Team to investigate opportunities for leadership training to address this situation. The Planning Team contracted with an outside firm to design and deliver training to improve the effectiveness of the managers.

Conditions for Self-Organizing. The organizational container was quite strong.

Employees identified with the company and saw themselves and their organization as exemplary. Significant differences within the company were based on organizational level and departmental association. Exchange between departments and between management levels was infrequent and formal. The organization functioned within clear hierarchical and functional boundaries.

Intervention. The stated hope of the Planning Team was that training would help break down organizational barriers and improve the adaptability of the management staff. Two training approaches were designed to meet the needs of the middle managers. The first was a practice-based program to teach managers how to give feedback to employees. The second was a case-based program to teach managers the properties of complex adaptive systems and to help them develop skills for dealing with system-wide, self-organizing patterns.

Outcome. Both programs were designed and piloted. The feedback course was accepted and delivered multiple times. This course focused on the relationship between manager and employee--a difference that made a significant difference in the system's existing patterns.

The complex adaptive systems course, on the other hand, was not continued. The curriculum design ultimately included the perspectives of participants and their one-to-one interactions and excluded the systems-thinking components of the CAS training. The Planning Team was committed to the system-wide perspectives of leadership and recognized the need for the managers to move the organization toward more adaptive

processes. Participants, however, saw the CAS course as irrelevant and too theoretical. The course focused on emergent patterns of behavior, differences that had not made a difference to the organization historically. In fact, by introducing the power of the agents in a self-organizing system, the CAS approach denied the reality of organizational structure and power, which had self-organized through previous interactions and was reinforced by a variety of mechanisms. Because familiar patterns of local, personal interaction were so coherent, participants were not convinced of the existence of self-organizing processes in their own working environments. They did not see themselves as empowered to influence the system-wide patterns of the future.

In addition, a major reorganization was underway during the intervention, which caused managers and staff to focus on that formal domain of coherent and habitual behaviors rather than participating in the emergence of relationship-based structures. The traditional coherence of the system was reinforced, and the planned intervention was insufficient to integrate the perspectives of the Planning Team and the participants into a new, coherent model of supervisory responsibilities.

The data showed that a minority of the participants found the information useful and reported that they had learned useful concepts, tools, and skills in the course of the CAS training, but the coherence of the working relationships was not changed by the intervention at group or departmental levels of the organization.

Instance 6: Health Care Think Tank

<i>Instance 6: Health Care Think Tank</i>	
Organization type:	Informal
Date:	1999
Presenting problem:	Concepts of complex adaptive systems can be applied to improve the effectiveness and efficiency of health care delivery.
Domain:	Team
Hypothesis:	A group of CAS and health care experts could propose a redesign of health care systems using principles of CAS. Exchanges across differences among health care and CAS experts in a retreat setting (physical and temporal container) would establish innovative solutions.
Condition:	Container, difference, exchange
Intervention:	Retreat meetings of experts provided: <ul style="list-style-type: none"> • Time and space container for work • Focus on differences among participants • Opportunities for transforming exchange
Outcome:	Included: <ul style="list-style-type: none"> • Individuals developed new ideas • Collaborations of small numbers of participants developed • Over time, the whole group collaboration dissolved without specific products
Changed coherence Resolved presenting problem:	No

Background. A consortium of community hospitals investigated ways to apply complexity principles to improve health and health care delivery systems. As one of their projects, the consortium identified a group of experts in both health care and complexity to work together to investigate possibilities for system-wide improvement. This informal

group of experts met repeatedly in retreat settings to explore common planning and action to respond to the needs of health care system.

Conditions for Self-Organizing. The containers for the group were interest in CAS and applications to health care. Also, the meetings were held in beautiful retreat locations, which lent a sense of "togetherness" to the experiences. Primary internal differences that drove the work of the group included health care/CAS expertise (though several members were experts in both areas), visionaries/practitioners, and preferred unit of analysis (individual, institutional, or community transformation). Another significant difference emerged from the approaches that various members took to the study of complexity in health care and in organization development. The practical and theoretical frameworks of participants were diverse, including public health, service delivery, medical research, financial management, organization development, and community development. Exchange loops were face-to-face meetings, email correspondences between meetings, and some group work for persons who lived and worked close to each other.

During each session, the group developed common models and shared perspectives, the conversations and patterns were coherent, and the group built and sustained energy. Little progress was made between meetings, however, so each retreat generated a new foundation.

Intervention. During the July meeting, several activities were framed to encourage practical applications of the previous findings and learning of the group. Small group discussions focused on what individuals, and their organizations, wanted from the work of the group. Several individuals, who had specific plans of action and/or products that

they wanted support for, were asked to make presentations to the group as a whole.

The closing conversation of the group was focused on making specific plans to carry out the intentions of the group. These interactions were designed to establish individual, small group, and large group containers that might set a context for self-organizing action.

In the course of these conversations, underlying and significant differences emerged and remained unresolved. Visionaries and pragmatists came into conflict about how the group should frame its mission and how focused the group should be on funding and external communications. Members of the group who valued practical applications wanted concrete and specific action plans. Academics and practitioners split their interests between research and practical applications of the concepts in real-world settings. All of these points of difference established conflict during the meeting, the exchange loops were insufficient to establish either a single focus for the group or a whole-system view that might integrate the various perspectives.

Outcome. After experiencing some friction and frustration in the course of the meeting, the group ended the meeting on good terms, though no commitment to group action was made. Each acknowledged the value of others' work, and recognized the unique contribution that each could make to the reform of health care. Work begun at the meetings continues in a variety of other business and academic settings. People continue to work together in small groups toward a variety of projects. The group, as a whole, however, has not met again, and no system-wide activities are planned for the future for this particular group. Though the meetings contributed to increased coherence at

individual and small-group levels, the working group was unable to establish sufficient coherence to continue its work as a group.

Creation of the group indicated a change in coherence in the field because individuals from a variety of organizations and disciplines came together to learn and work.

Throughout its history, the group came together periodically and experienced the internal dynamics that established coherent system-wide patterns temporarily. As a result of these periodic engagements, individuals built personal conceptual coherence and small groups formed to pursue various projects. One of the resulting groups formed a successful for-profit venture, and another established a non-profit institute to continue to pursue shared purposes. These outcomes at individual and sub-system levels were valuable for participants, but the group as a whole did not establish sufficient coherence to sustain its existence as an entity over time.

Instance 7: Restorative Justice

<i>Instance 7: Restorative Justice</i>	
Organization type:	Non-profit
Date:	1999-2000
Presenting problem:	Group of community members unable to work together toward common goal.
Domain:	Team
Hypothesis:	Reinforcing the container would overcome destructive differences and disruptive exchanges.
Condition:	Container
Intervention:	Retreat to: <ul style="list-style-type: none"> • Discourage conversation about group topics outside of group meetings. • Reinforce shared values and visions. • Focus the work of the group.
Outcome:	Differences were amplified. At the end of the retreat, the group dissolved.
Changed coherence Resolved presenting problem:	No

Background. Restorative justice is a movement in the criminal justice system that focuses on the healing and learning aspects of justice in addition to the need for retribution. Circle sentencing is one technique that supports the restorative justice approach. In Circle Sentencing, community members come together to work with selected offenders. The offenders are referred to the Circle by a judge as an alternative to the traditional sentencing, pardon, and parole systems. Together, the Circle and the offender establish a contract to define what the offender will do to restore the victim, the offender, and the community to health.

One such sentencing Circle was established in the small rural community. Initially the group included fifteen to twenty community members who met weekly to consult with the offenders who had been referred to them. Over time, however, a schism developed in the Circle. Many members left, and those remaining had many difficulties making decisions and working productively with offenders.

Conditions for Self-Organizing. The container for the Circle was their shared desire to find an alternative to traditional retributive justice. All members of the Circle shared this fundamental value.

Differences in the Circle were many and difficult to identify. Members had different communication styles, personal experiences, religious convictions, values, histories in the community and with law enforcement systems. They had received various levels of training in Circle procedures, and they took different stances toward offenders who were referred to them. The diversity in the group seemed most marked and destructive during discussions of funding, decision making, organization of the group. This indicated that the most divisive differences were in levels of real and perceived power of members of the group.

Members of the group talked about the primary difference within the Circle in terms of their definitions of "justice." One group described itself as interested in "what is right for the offender, not just what feels good." The other group described itself as "concerned about the offender's development and relationship to the community, more than whether or not they got what they deserved." Such a fundamental difference in the definition of

justice, the group's reason for coming together, led to a variety of apparently irreconcilable differences.

The formal exchange patterns of the group were determined by the "Circle process." In this small group facilitation method, individuals sit in a Circle. One member, the Circle Keeper, asks a question of the group. A talking piece is passed around the Circle to each member in order. When holding the talking piece, the participant can say anything he or she chooses in response to the Circle Keeper's question. This formalized exchange mechanism allows each member to articulate his or her unique perspectives.

Theoretically, and often in practice, as the talking piece goes around the Circle, patterns emerge to shape the shared meaning and intention of the group as a whole. This approach had not been effective in framing or resolving the underlying differences in the Circle.

The most powerful and influential member was hearing impaired and was unable to hear or respond appropriately to contributions of other members.

An informal, alternative feedback pattern emerged in this Circle. Individuals talked with each other about Circle issues outside of formal meeting settings. Factions emerged, and trust deteriorated among individuals and between factions.

Intervention. By the time we were called in to work with the Circle, only six members remained. We talked with them about differences that divided them, hoping that constructive exchange across the differences would establish a cohesive group. This approach elicited one of two reactions. First, the group expressed polite denial. No difference was too great, and they respected and were willing to work together.

Occasionally, however, one or another member of the group would become outraged and blame others in the group for one or another action in the past.

We recommended two interventions to strengthen the container and put differences to constructive use. The first was that they make a pact not to discuss Circle business outside of Circle. The hope was that this rule would interrupt the informal communication patterns and encourage participants to raise issues for resolution in Circle. Two members of the group refused to agree to this procedure, so it was not implemented. We also recommended a two-day retreat to allow time for members to reinforce their common goals and commitments.

Outcome. In the two-day retreat setting, the group focused on using the Circle Method to build the cohesion of the group. Other strategies for group interaction were recommended, but the group chose to continue to use the Circle Method in an effort to resolve their differences. Rather than bringing the group together into a single container, this approach accentuated the two primary factions. As the talking piece went around the Circle, and individuals voiced their own perspectives and needs, others interpreted the statements as attacks or blaming. At each round of talk, the differences became greater rather than less. By the end of the retreat, the group decided to dissolve. Though the Circle Process has been used in many situations to help a group build common understanding and shared goals, in this situation it was unsuccessful. The exchange strategy increased the divergent coherence within each faction. As a result, coherence of the whole was not achieved.

Instance 8: County Library

<i>Instance 8: County Library</i>	
Organization type:	Governmental
Date:	2000-2001
Presenting problem:	Distrust of leader's ability in times of change.
Domain:	Team
Hypothesis:	Containers are clear, and exchange is frequent but unproductive. Articulating differences that make a difference will reestablish trust.
Condition:	Difference
Intervention:	Facilitation to: <ul style="list-style-type: none"> • Articulate roles and responsibilities for all management levels. • Clarify decision-making processes.
Outcome:	Included: <ul style="list-style-type: none"> • Managers and workers expressed increased trust in leader. • Cooperation and collaboration across the organization increased. • Comfort with rapid and unpredictable change increased.
Changed coherence Resolved presenting problem:	Yes

Background. This County Library is large, well-funded, and well respected across the country. In 1994, a new director came into the system. His predecessor was an effective traditional leader. Policies and procedures were stable, roles were clear, and power was clearly held in the hands of a few formal leaders. The new director found, however, that the library was not adapting readily to new technologies, changing demographics in the community, or new stakeholder expectations. In an effort to make the system more

adaptive, the new leader reorganized departments, removed layers of middle management, pushed decision making down into the organization, established team-based decision making, encouraged interdependencies among departments, and initiated training and travel programs to introduce new ideas.

An employee satisfaction survey in 1998 uncovered serious unrest among all levels of workers. Two senior library managers complained to County Administrators that the library was in shambles and that something had to be done. This news was shocking to the director, who had received warm receptions from staff and high praise for his innovative efforts.

Conditions for Self-Organizing. The Library had a strong sense of identity. The long tenure of the previous director had provided a sense of security and reliability for employees and managers alike. This cultural container was threatened by the innovative interventions of the director.

Exchange loops in the old Library were formal and predictable. Lines of authority and decision making were clear, messages were unambiguous, and consequences were predictable. The new structures and procedures introduced the need for continuous and productive conversation. Teams had to work through difficult and ambiguous problems. Senior management was expected to respond to changing needs. All service providers were asked to listen and respond to their patrons. None of these feedback loops was clear or predictable.

The absence of historical power structures and emergence of ambiguous communications left employees confused about their roles and those of management. The result was loss of faith and trust in the leader himself. In addition, the desire for stability and calm encouraged staff to avoid confrontation, leaving the director clueless about the implications of his decisions on service delivery and employee satisfaction.

Intervention. The container and exchange structures of the institution had already been shifted by the director. He had stated a new, more adaptive mission for the library to replace the old mission of stability. The changes in management and decision making already forced people to talk with each other. The missing link, which generated the discomfort, was that individuals and groups were not articulate about the differences they encountered. For this reason, the intervention focused on defining difference and valuing diversity of opinion and approach. Several specific recommendations were made to establish more effective means of dealing with difference.

The new director was coached to be more articulate about why he made the changes he made. Rather than seeing the new expectations as personal preferences of the new director, staff was presented with an integrated picture of a future and how it was different from the past. The senior management team was encouraged to think about their differences objectively and to look for ways that the team might benefit from their unique abilities and interests.

Individual departments within the Library were encouraged to document their own mission statements, then to present them to other departments and discuss how their differences could be used productively.

Specific business and technical issues were analyzed in terms of the positive, neutral, and destructive differences they generated. Managers and staff were taught and encouraged to use effective exchange to surface and resolve significant differences.

The director instituted periodic one-on-one conversations with his direct reports. The purpose of these meetings was to establish appreciation for individual differences and to encourage authentic and timely communication about problems, concerns, and opportunities.

Outcome. The traditional, equilibrium-seeking culture of the Library was already changed by the early interventions of the new director. The more open leadership style threatened the comfort of the individual employees. The ability to identify and negotiate differences, however, provided tools to help both individuals and groups come to terms with their new realities. The increased capacity to deal with difference also established a more responsive service philosophy in the Library and helped staff recognize and explain to others how the library was changing.

Follow up interviews six months after the initial interventions demonstrated that senior managers were more comfortable with and confident in the leader and the process of change than at any previous time. The levels of trust and willingness to work together indicated improved coherence of the system-wide organizational structures of the Library.

Instance 9: Environmental Training

<i>Instance 9: Environmental Training</i>	
Organization type:	Non-profit
Date:	2000
Presenting problem:	Successful training company lacked sufficient infrastructure to expand, but values rejected traditional structure and power relationships.
Domain:	Institution
Hypothesis:	Passion for and talk about a shared mission were insufficient to provide container and exchanges for a coherent organizational structure. Articulating differences will provide a structural foundation for expansion.
Condition:	Difference
Intervention:	Retreat to focus on: <ul style="list-style-type: none"> • Differences that make a difference in the content of training and in the organizational structure. • Differentiation of roles and responsibilities to perform necessary functions.
Outcome:	Included: <ul style="list-style-type: none"> • New, focused mission statement • Clearer relationships with partners • Innovative organizational structure defined to meet new mission
Changed coherence Resolved presenting problem:	Yes

Background. The organization is a non-profit environmental education association. Its mission is to bring together groups of individuals who are interested in learning about what they can do to preserve a healthy environment. The organization uses instructional materials and a delivery approach developed by an affiliate organization.

The organization is relatively new. In the early stages of its growth, the group has depended on the energy and commitment of its Executive Director. Internal policies and procedures are informal. Increasing demand, however, indicates that more structural support will be necessary to continue the work. In an effort to establish more formality, the Executive Director called for a one-day planning retreat.

Conditions for Self-Organizing. The mission of the group forms a powerful container for the organization, which draws interested parties into the activities of the group.

Differences in the group have been informal and not well defined in the past. The level of interest and participation varies greatly. The Director, herself, provides most of the organizing work. Leaders are trained to support new groups. Board members provide suggestions and support specific projects. Participants in the training sessions consider themselves members of the movement, but no membership structure has been defined to clarify the external boundaries or levels of participation. The integrating message of the training--focusing on ecological interdependencies--encourages the organization to focus on similarities rather than differences. Differences among membership levels, responsibilities, skills, or responsibilities have not been defined.

Exchanges among Board members involve frequent email and phone contact to discuss specific tasks and monthly Board meetings in which the group identifies and resolves operational issues that have emerged in the preceding month or are anticipated in the next.

Intervention. The Director and the Board recognized the need for more formal structures, but their ecological perspective made them skeptical about traditional organizational

approaches. Their goal was to establish an organizational foundation that was consistent with their belief in interdependence and emergence.

The day-long retreat began with a short training session on the distinctions among organized, self-organizing, and unorganized activities. The Board identified which of their activities required which level of organization. The training also presented the conditions for self-organization and led the group through an analysis of containers, differences, and exchange loops that would be natural for their work together.

They decided that effective distinctions--between the organization and its market and among participants--were the most critical missing link in their self-organizing process. To respond to this need, the Board redefined the mission of the organization. Previously the Board had seen itself and the Executive Director as responsible for all stages of a participant's activities, from orientation to personal commitment to life-time follow-up. During the conversation, Board members recognized that their energies should focus only on one stage of the process. The group also came to an understanding about the specific tasks that were required, and they explored the unique skills and interests of each Board member. The decision was made to focus training on building awareness of ecological issues. Other groups, they agreed, were better able to provide opportunities for action. This insight was quite valuable to the group. Previously they had struggled with opportunities to lobby, provide additional courses, support action teams, and provide on-going support to all participants. This re-framing of the mission provided a realistic and powerful goal for the group to move toward.

Second, the Board considered its organizational differences. It defined levels of membership and established roles and responsibilities for each. Within the Board, specific tasks and functions were defined and assigned to individual members, thus relieving the Director from direct control over all organizational functions. These discussions of differences led naturally to discussion about appropriate exchange loops to keep the organization growing and to keep its parts connected to each other.

Outcome. The solutions proposed during the retreat have been implemented. Some Board members feel constrained by the organizational distinctions, but expectations have been clarified, and a new foundation is set to support the organization in the next cycle of its self-organization. The intervention resulted in a new, more focused mission statement, clearer identity for the group to support relationships with other partners, and an innovative organizational structure that met both of the organization's primary needs: respect the organic nature of the group and clarify working responsibilities and relationships. All of these characteristics indicate increased coherence for the Board as a team and for the organization as a whole.

Instance 10: Study Group

<i>Instance 10: Study Group</i>	
Organization type:	Informal
Date:	1995-1996
Presenting problem:	Desire to merge two groups with similar missions and different memberships.
Domain:	Institution
Hypothesis:	Differences between the groups were not significant, and the separate containers were historical artifacts. A temporary container with active exchange will allow the two groups to merge.
Condition:	Container
Intervention:	Retreat: Conduct a one-day retreat and invite members of both groups to participate.
Outcome:	At the end of the retreat, members suggested that the two groups be merged into one.
Changed coherence Resolved presenting problem:	Yes

Background. This study group is a community of practice that focuses on applications of chaos and complexity to management and organization behavior and development. The first group began meeting in June, 1995. A second group started meeting in January, 1996. The second group was formed to avoid breaking up the emerging coherence in the first group by expanding membership too quickly.

Conditions for Self-Organizing. The container of the groups is defined by membership on an invitation-only basis. Members share an interest in and basic knowledge of CAS and its applications to organizations. Differences within the groups include levels of expertise

in the field, professions, organizational affiliations. Difference between the two groups was primarily the length of tenure, though the second group developed greater interest in practical applications and possible business ventures than the first one.

Feedback patterns for both groups included the discussions during monthly meetings and notes taken at the meetings and distributed to all members. The norm and practice of both groups is inquiry-based discussion. Competitive or adversarial exchange is not a common practice.

Intervention. In May of 1997, the administrative costs of sustaining two groups became prohibitive, and both groups had matured to the point that they were stable and could absorb members from the other. The objective was to establish a container that could mix the two groups without inviting too much turbulence or losing the special character of either. An all-day retreat that included members of both Consortia established the larger container. During the day, members of both groups came to know each other. They participated in conversations much like the monthly meeting conversations.

Outcome. The previous perception of "us" and "them" evaporated. At the end of the retreat, one of the members suggested that the groups should be merged. All members present agreed, and the merged group continues to function productively.

Instance 11: Regional Office of Religious Organization

<i>Instance 11: Regional Office of Religious Organization</i>	
Organization type:	Religious
Date:	1998
Presenting problem:	Organizational culture inhibits integrated planning and delivery of services.
Domain:	Institution
Hypothesis:	Tradition and history have established rigid boundaries and unproductive exchanges. Redesign of differences, patterns of exchange, and container will shift the organizational culture.
Condition:	Container, difference, exchange
Intervention:	Multiple, including: <ul style="list-style-type: none"> • Define new organizational and committee structures. • Redesign office space to be more integrated and fluid. • Conduct SimuReal session to improve understanding across the institutional container. • Develop and implement consistent meeting procedures.
Outcome:	Included: <ul style="list-style-type: none"> • Organizational silos weakened, but did not disappear. • Changes within the organizational system allowed for more and better contact with outside constituencies.
Changed coherence Resolved presenting problem:	Yes

Background. This international religious membership organization includes a regional structure. This particular regional group comprises the local churches that are located in

the state, the Bishop over the area, and a centralized staff and structures that support local churches, resolve conference-wide issues, and maintain contact with the global church bodies. In consonance with the global recommendations about mission, vision, and structure for the church of the future (see Instance 3: International religious membership organization), this regional institution decided to reorganize its offices and management committees.

Conditions for Self-Organizing. Traditionally, the container for the organization had been strong and explicit. It was geographically bounded to include only churches in the region, and it was institutionally bounded to include only churches within the denomination. Within these containers, the organization held many significant differences, including local church/global church affiliations, lay/clergy members, urban/rural locations. Formal boundaries, in the form of a complicated committee structure, also addressed special interests of constituencies. Other differences affected the internal dynamics of the organization, including definitions of and commitment to social justice issues, theological perspectives, age, and levels of community wealth.

Exchange loops for the group fell into two types. One was the personal connections that had developed over time between and among individuals in the community. The second were the formal channels of reporting and decision making among the formal roles and committees represented at both the local church and the regional organization.

The existing exchanges were insufficient to ensure understanding, trust, or cohesive action across the myriad significant differences. As a result, formal structures had been

added over time in an effort to "ensure" trust and to guide the actions of individuals and groups within the institution.

Intervention. A new organizational structure was defined. The purpose of the structure was two-fold. 1) Focus more clearly on a shared vision and mission that would establish a mission-based container. 2) Simplify the governance structures so that they focused on the most significant differences and made it easier for individuals to understand and take action.

Three activities served to establish and reinforce the new patterns of interaction. First, the regional offices were redesigned. Central space was shared, and private offices were arranged according to the new organizational design. This established a physical symbol of the new container for the organizational activities. Second, staff and volunteer leaders across the organization were invited to participate in a one-day SimuReal. SimuReal is a large-scale technology in which members of a system work within a simulated environment and reflect on their own and others' actions (Bunker & Alban, 1996). The purpose of the SimuReal in this intervention was to test and reflect on the new organizational structure. This group exercise allowed individuals and the group as a whole to redefine the differences that made a difference within the proposed container--the organization of the future. Third, a standard process for planning, facilitating, and reporting meetings was instituted. This supported the reliability of feedback loops among individuals in small functioning groups and between the small and larger groups.

Outcome. Internal dynamics of the organization have been slow to change. Given the new office arrangement, and their intimate involvement in planning, some staff members

made the transition to the new approach more quickly than clergy or lay persons outside the regional office. Special interest groups, who had been represented in the previous committee structure, were slow to recognize their roles in the new organization. Central, collaborative, vision-oriented groups found it difficult to work in new ways-- thinking about the whole and the parts simultaneously. Evaluation of the changes was difficult because the new, interactive structure evolved in ways that were not predictable. Overall, the changes were perceived to be positive, and increases in system-wide coherence been evident but slow.

Instance 12: Retail Creative Services

<i>Instance 12: Retail Creative Services</i>	
Organization type:	Business
Date:	1999
Presenting problem:	Creative and logistical teams do not work well together.
Domain:	Institution
Hypothesis:	Business function provides a clear container, but differences in schedules, needs, and personal styles inhibit system-wide patterns of cooperation. More effective exchange patterns will allow diverse groups to function more effectively together.
Condition:	Exchange
Intervention:	Meeting redesign to: <ul style="list-style-type: none"> • Include detail system reports as pre-work. • Focus on action items and accountabilities around shared tasks. • Encourage questions, rather than statements.
Outcome:	Included: <ul style="list-style-type: none"> • Specific long-standing issues resolved. • Improved individual working relationships. • Reduced tension at and between meetings.
Changed coherence Resolved presenting problem:	Yes

Background. In a retail environment, advertising requires both creativity and schedule reliability. The retail organization depends on a marketing group that includes creative staff and persons who manage the logistical issues related to advertising production and placement. The interactions of the creative and logistical teams were not always

productive. Previous staffing changes had increased tensions, required additional rework, and threatened the quality of products generated by the group.

Conditions for Self-Organizing. The functional container that shaped the emerging process was one of time--ads had to go through conception, design, layout, production, and placement within immovable deadlines. Differences across the system were clear and strong. Some personnel were responsible for creative content of the ads. These persons described themselves as "creative" types. Other personnel were responsible for accuracy and production schedules. They described themselves as detail oriented and reliable.

Exchange loops between the groups were often handled with notes written on product packages. A weekly meeting was designed to identify issues and monitor progress on specific projects.

The creative staff saw these meetings as a waste of time, because they were told about things they already knew or that they could not control. The logistics personnel were frustrated by the meetings, too. They felt they were not being heard and that the creative staff did not respond to their requests for action. The meetings, which might have been effective opportunities for exchange, increased frustration between the two groups.

Intervention. The purpose of the intervention was to shift the design of the weekly meeting to encourage transforming exchange, rather than one-way information sharing. To respond to this need, the project status information was documented and distributed to everyone before the meeting. This took care of the information exchange component of the meeting and left meeting time for resolution of issues. A task list was generated to

cover specific actions required of each person. During the meeting, creative and logistics staff both reported on progress on particular tasks. In this way, individuals were held accountable to fulfill their commitments. Finally, everyone was encouraged to track the numbers of questions and statements that were made in the course of a meeting. The goal was to increase interrogatory statements to encourage both sides to listen to and learn from each other.

Outcome. The weekly meetings have become much more productive and satisfying both for the creative and the logistics staff. Though underlying tensions remain between the individuals and the processes that focus on creativity or production, the weekly meeting has become a place to surface and resolve those issues, rather than the stage on which the tensions are played out. By increasing the coherence of the periodic meetings, the group has achieved higher levels of coherence and effective interactions in their processes and relationships.

Instance 13: International Mortgage Servicing

<i>Instance 13: International Mortgage Servicing</i>	
Organization type:	Business
Date:	1999
Presenting problem:	Diverse customer populations, wide variety of services, rapid technological and organizational change inhibit consistency and predictability of service quality.
Domain:	Institution
Hypothesis:	No reliable container or clear differences can be defined for the group. Reliable transforming exchanges across organizational differences will increase consistency and predictability.
Condition:	Exchange
Intervention:	Process design: <ul style="list-style-type: none"> • Identify communications manager to collect and distribute messages within and outside of the working group. • Use diverse feedback mechanisms and cycles to respond to diverse and ever-changing information needs.
Outcome:	Included: <ul style="list-style-type: none"> • Increased cooperation and coherent action across the organization • More responsive and higher quality customer service
Changed coherence Resolved presenting problem:	Yes

Background. The organization is a subsidiary of an international conglomerate. Its business is to buy, package, sell, and service residential mortgages. The Department of

Corporate Services provides support to the entire corporation in the areas of Human Resources, Information Technology, Marketing, and Administration.

Four central issues affect the changing work of the Corporate Services Department. First, the organization is growing quickly through acquisitions. Each new acquisition (average five per year) brings with it human resources, information technology, marketing, and administrative services that must be integrated with existing services. Second, a corporate-wide drive to increase margins puts special pressure on "overhead" functions that are supported by Corporate Services. Corporate-wide, business units are considering out-sourcing services, such as information technology, to reduce cost and increase responsiveness. Third, many of the new acquisitions are international. Issues of language, organization, and culture are especially relevant to the work of Corporate Services. Finally, rapid changes in hardware and software technology make IT decisions more costly and risky at the same time that they become more central to business processes.

Conditions for Self-Organizing. Within this context, stable containers are difficult to find. Personnel changes at all levels, including management, make group membership fluid. Moves toward team-based decision making and flattened management structures have increased the ambiguity of leadership roles. Multiple locations, especially international ones, make physical location irrelevant. High turnover of technical personnel and technical tools leaves little stability in terms of process or procedure. Rapid business changes bring about frequent shifts in mission and vision, and time for communication and reflection are severely limited.

Differences within the system are many and growing. The primary functions of Corporate Services introduces four different business perspectives--human resources, information technology, marketing, and administration. Each has a strong and unique professional culture. Within each division, levels of technical skills, intimacy with leadership, and connection with the client establish another layer of complicated differences. Geography, language, culture, corporate history, and professional expectations also shape the interactions of individuals and groups within each division and the Department as a whole.

Exchange in the system is primarily informal. The head of Corporate Services maintains personal relationships with many people at various levels of the organization. Email and voice mail are the primary formal modes of communication, but the complicated nature of the business and the organization mean that individuals are overwhelmed with messages of both types. Face-to-face meetings provide some opportunity for transforming exchange, but the norms of the organization do not include agendas, structured meeting procedures, or complete and accurate minutes.

Intervention. At first, it seemed that an intervention based on corporate differences or containers might be most appropriate. This would involve clarifying roles and responsibilities, establishing mission and vision statements, and articulating levels of management clearly. In a different industry or at a different time in the real estate mortgage industry, such approaches might have been feasible. In this case, however, the environment was too turbulent to allow for such stabilizing influences.

The intervention, then, was based on establishing an exchange network to help parts of the organization synchronize their activities without constraining them within well-defined containers. One person was identified as the Communications Manager. She described herself as the organizational "meaning maker." She designed a Communications Plan for the Department. The plan includes 1) Periodic face-to-face and email reports that are sent to a central source, consolidated, and mailed out in a batch; 2) Large group interventions that allow individuals and groups to talk about shared issues; 3) Common language established through consistent messages coming from high-level management; 4) Clear distinctions and procedures defining what kinds of communication channels are appropriate for what messages; and 5) Encouragement for individual groups within Corporate Services to build their own communication plans that incorporate the same iterative, distributed, and periodic patterns shown in the Department-wide plan.

Outcome. The Communications Manager receives requests for information. She also is asked to review documents and make recommendations about media and messages.

Several divisions have voluntarily developed their own communications plans.

Coherence of the system as a whole has increased following this intervention. Regular meetings are well attended and have served to increase the flow of constructive information and reduce the flow of rumors. Over time the increase in effective exchange has helped the system self-organize and establish stable containers that can support the separate and shared work of the organization.

Instance 14: Research and Service Institute--Organizational Learning

<i>Instance 14: Research and Service Institute--Organizational Learning</i>	
Organization type:	Non-profit
Date:	1999
Presenting problem:	Research, service delivery, administrative, and materials productions functions not integrated.
Domain:	Institution
Hypothesis:	Departmental containers focus on differences between departments and restrict exchange across the system. Cross-functional teams will form new containers to encourage system-wide exchange and incorporate strategic differences into planning process.
Condition:	Container
Intervention:	Meeting design to: <ul style="list-style-type: none"> • Establish cross-functional learning teams to focus on specific issues of shared, systemic interest. • Reports from Teams to Executive Team to inform strategy and budget. • Reports to staff to disseminate findings.
Outcome:	Included: <ul style="list-style-type: none"> • Process defined and implemented. • Individuals developed relationships and understanding of others. • Institution-wide strategies proposed. • No policy impact because Executive Team refused to receive and act on reports of Teams.
Changed coherence Resolved presenting problem:	Yes

Background. This organization is a social service research and consulting non-profit corporation. They publish their findings on youth and community development and provide support to communities wishing to implement programs based on their research

(See Instance 1: Research and Service Institute--Evaluation). The organization is designed according to functions: Publishing, Research and Evaluation, Training and Consulting, Administration. Historically, each division functioned independently. Coordination among them was handled by senior management or on specific projects, where multiple functions were required.

New opportunities for service, which arose in the late 1990s, required more integration of services. Research findings needed to move into publications and consulting activities quickly. Findings from the training and consulting personnel needed to influence the design and findings of research scientists. Clients who asked for training required evaluation support or help producing documents. As a result, the organization recognized the need to move out of the organizational silos and find ways to work together more productively.

Conditions for Self-Organizing. The history of the organization forms a strong container. Led by a visionary, the organization has a strong sense of its role in helping establish healthy youth and healthy communities. Personal commitment to the primary product establishes a strong sense of identity for staff members and other stakeholders. Differences in the system are large, however, and have become more exaggerated over time. Each department focuses on its own set of products and services. Though theoretically interdependent, each one functions as if it were independent. Exchange loops among the departments are managed by an Executive Leadership Team. Issues regarding project constraints (such as resources, quality criteria, schedules, outcomes, and procedures) are resolved on a project-by-project basis by members of the Executive

Leadership Team. This group, however, is not recognized as effective in negotiating to consensus or communicating their findings consistently across the organization. Though the organization is relatively small (80 employees), informal conversations between staff in different departments are not common.

Intervention. A learning organization design, involving container redesign, was created and implemented to establish more productive interaction among departments and to address some systemic issues for the organization. The design established cross-functional teams of volunteers to focus on specific issues of strategic interest to the organization. Each team included experts and interested parties from all departments and at least one member of the Executive Leadership Team. The issues to be addressed were identified by the Executive Leadership Team during a series of strategic planning sessions.

A detailed process was designed that included proscribed questions and deliverables for each stage of the team's work. The process included a report from each team to the Executive Leadership Team and a presentation to the whole staff about the team's findings. Each team leader received a packet of information and training in the process.

Outcome. The work of the teams was highly successful for the persons involved. They came to understand a systemic and strategic issue well. They built relationships with persons from other parts of the organization. They identified more clearly the significant differences in the work of each Department, as well as what they shared in common. The recommendations were innovative, and the groups were excited about their action plans.

Communication with the Executive Leadership Team, however, was less satisfying. Before the learning process was designed, the executives had agreed, individually and collectively, to listen and respond to the findings of the teams, and to integrate the findings into strategic and budget planning for the coming year.

As groups began to complete their work, they approached the Executive Leadership Team about how to communicate findings and receive feedback. After some time of avoiding the question, members of the Executive Leadership Team announced that they did not have the time to review the findings or to provide their responses as a group. Reports of the work were provided to interested personnel and to the Executive Leadership Team members. The budget for the next year reflected some of the recommendations from the teams' work. Some individual Executive Leadership Team members provided individual responses to the work of some teams, but the Executive Leadership Team, as a whole, did not respond. This process provided a variety of tactical benefits to the organization: improved communication, better understanding, new relationships. It was not able, however, to establish clear strategic benefits.

Because of the flow of information and individual learning, organizational patterns related to service delivery improved in coherence. Members of the organization were able to work more effectively together, though the budgeting and strategic planning processes for the organization were not explicitly affected by the intervention.

Instance 15: County Social Services

<i>Instance 15: County Social Services</i>	
Organization type:	Governmental
Date:	1999
Presenting problem:	Social service delivery fragmented and not responsive to clients.
Domain:	Institution
Hypothesis:	Containers reinforced differences among departments and constrained exchange across boundaries. New, system-wide containers and formal transforming exchange opportunities will improve integration of services to clients.
Condition:	Container, exchange
Intervention:	Multiple: <ul style="list-style-type: none"> • Establish over-arching objectives • Provide structures for transforming exchange at various levels and purposes • Facilitate interaction of leadership team
Outcome:	Included: <ul style="list-style-type: none"> • Improved individual and departmental willingness to work together • Multiple service delivery projects emerged • Integrative efforts initiated by workers • System-wide infrastructure components identified
Changed coherence Resolved presenting problem:	Yes

Background. In a large urban county, ten departments are responsible for the delivery of human services. The departments include: Community Corrections, Economic Assistance, Veteran's Services, Training and Economic Assistance, Community Health, Adult Services, Children and Family Services, Health and Human Services Policy

Planning, an integrated medical and human services clinic, and the county hospital. Historically, these departments have worked independently, focusing on delivery of mandated programs and services. Changes in the economic and political environments and in the needs of their clients convinced County Administration that human services should be integrated to reduce costs and improve outcomes.

Directors of the ten departments began regular weekly meetings to explore ways that their departments might integrate services. This leadership group initiated and sponsored a variety of projects to experiment with integrated service delivery. They also embarked on a Strategic Planning Process to support integration of services across the departmental boundaries.

Conditions for Self-Organizing. The departmental containers for the work were clearly defined and reinforced by organizational structure and funding flows. Each department delivered programs that were regulated by different state agencies.

Differences between the departments included funding and reporting requirements that were specialized by program. Political alignments between department heads and elected members of the County Board also reinforced the autonomy of the departments. Policies, procedures, communications, and information systems were designed to serve specific needs. Differences between the departments were amplified, while similarities were minimized.

Feedback among the departments was minimal, until the establishment of the Leadership Team. Data management and applications, physical location, training and day-to-day procedures limited the exchange of information and resources among the departments.

Organizational redesign and integration were rejected as a solution to the problem. It would have been possible to reorganize and re-engineer services to force integration, but previous attempts at such interventions had not been successful. Political, regulatory, and union requirements mitigated against organizational integration.

Intervention. Without the force of an organizational realignment, the project had to establish another container to bring the group into cooperation. This required two interventions. First, an overarching container was established to amplify the similarities and damp the differences among the departments. Second, a system of exchange loops was established to encourage shared learning and problem solving among the departments.

The commonality, which was to serve as a new container for the group, was the client base of persons who needed services from the county. A set of overarching client objectives was defined to articulate the integrated work. These objectives and their related client outcomes provided the focus for action toward integration.

The exchange design involved a variety of large- and small-group activities, including:

- 1) Directors' meetings, which were held weekly. This communication among Directors provided the possibility for unified strategies and broad-based support for integrated

action; 2) Shared Outcomes Initiatives, which were pilot projects for integration of services. These projects took a variety of forms. Some were mandated and sponsored by the Directors. Others were initiated by work groups as a result of their employee working sessions. Designs and findings of these initiatives were disseminated through a variety of media including Directors' Reports, an on-line conferencing system, and periodic training and sharing sessions; 3) Strategic Action Conferences, which were held quarterly. These large-group meetings established requirements for systemic changes to information systems, data sharing, communications, and human resource practices; 4) Thinking and Doing Sessions. These were special meetings of workgroup units and cross-functional ad hoc committees. During these meetings, individuals and teams were asked to assess their current activities toward the overarching objectives and to provide information to remove operational, systems, and policy barriers to integrated services. They also encouraged individual action and accountability.

Outcome. The project is still in process. To date, however, a variety of positive outcomes have been identified, each of which represents an increased coherence at a system-wide level. Department Directors and their managers and supervisors recognize and articulate interdependencies among their departmental work. Some service providers take the opportunity to improve their own levels of service and to provide information to support changes in operations and systems that lie outside their immediate control. Budget and performance appraisals are being used to reinforce actions toward effective integration. Systems that provide infrastructure for the work (data management, communications, finance, human resources, and organizational structure) are being transformed to support integrated delivery of services. All employees are challenged to think of their work in

terms of shared outcomes to clarify how their work fits into the overarching objectives identified by the Leadership Team. Across the organization, small groups of staff are banding together to instigate innovations in service delivery. These internal changes are beginning to affect individual clients, who are able to receive integrated services to support their own development toward safety, stability and self-reliance, and livable income.

Instance 16: Liberal Arts College

<i>Instance 16: Liberal Arts College</i>	
Organization type:	Non-profit
Date:	1999-2000
Presenting problem:	Geographically separate units of single institution function as independent agents.
Domain:	Institution
Hypothesis:	In spite of a strong shared mission (container) geographical and historical differences make transforming exchange difficult. Focus on an organization-wide administrative container will improve consistency and efficiency of administrative functions.
Condition:	Container, difference
Intervention:	Organizational design: <ul style="list-style-type: none"> • Establish single Management Committee over whole institution. • Distinguish between system-wide and local concerns and responsibilities. • Articulate the significant differences between the two sites.
Outcome:	Improved and integrated administration of the whole institution.
Changed coherence Resolved presenting problem:	Yes

Background. This is a four-year liberal arts college with an all-required curriculum. The total student body of less than 1000 is divided between two campuses--one in Annapolis, Maryland and a second in Santa Fe, New Mexico. The college has a single Board of Visitors and Governors for both campuses, two presidents, one alumni body, three endowments (one for each campus and one for the college as whole), two deans, and one

faculty (though faculty members identify with one or the other campus). Financial and operational differences between the campuses generated a variety of problems including unequal resources, inconsistent marketing and outreach strategies, diverse data collection and management approaches. A Governance Committee was established by the Board to investigate options to clarify and improve the effectiveness of management on the two campuses.

Conditions for Self-Organizing. The Program of Instruction is the primary container for the work at the college. The campuses deliver virtually identical educational programs. Students transfer easily from one campus to the other, and faculty occasionally move between the campuses, too.

Differences between the campuses emerged from geographical locations and personal and professional styles of the leaders on each campus. Office procedures and budget priorities differed on the two campuses. Intercampus communications became difficult. College-wide administration was non-existent, though a single Board of Visitors and Governors strove to develop consistent strategic direction on the two campuses.

Four formal exchange mechanisms sought to bring the campuses together across their differences. The single governing Board received reports from and gave guidance to campus leaders. The common alumni body shared information between the campuses. A Joint Instruction Committee established communication links between faculty and administration on issues related to the program of instruction. An Administrative Coordinating Committee without formal authority supported communications between the campus administrative offices.

Intervention. The Governance Committee investigated the specific differences between the campuses to determine what level of integration would be desirable and practical. Some differences (e.g., facilities management, relationships with the community, and local traditions) were deemed to be healthy and desirable. Some differences (e.g., minor curricular differences, disciplinary practices, and leadership style) were deemed to be irrelevant to the work of the college. Other differences (faculty salaries, tuition, and endowment) were identified as unproductive. The work of the Committee was to design a governance process that would maintain the productive, ignore the irrelevant, and resolve the destructive differences between the campuses.

A new functional and organizational container, a Management Committee consisting of presidents and deans from both campuses, was established to support integrated action on the two campuses. The purpose of the Management Committee was to resolve critical college-wide issues. Critical college-wide issues were defined by the Governance Committee to include advancement, computer systems, resource management and college-wide budget, alumni relations, admissions and financial aid policy, and strategic planning. The Governance Committee determined that these functions should be consistent between the campuses. They recommended that a Management Committee be established, consisting of the presidents and deans of the two campuses. One of the presidents would serve as the chair of the Management Committee and in this role take executive authority over college-wide functions. The Management Committee would serve in an advisory role. Meetings of the Management Committee would provide transforming exchange between the two campuses, and the role of the chair would provide the integrating decision-making role for college-wide functions.

Outcome. The recommendation of the Governance Committee was accepted by the Board of Visitors and Governors, and the Management Committee was initiated smoothly. As expected, the new structure provided more integrated and coherent information for Board decision making and more consistent and efficient administration for both campuses. Members of the Governance Committee had speculated that the increased administrative coherence between the campuses would enable the Board to focus on strategic, rather than tactical, issues. In fact, during the first Board meeting following implementation of the plan, strategic issues emerged in many of the standing committees of the Board.

Instance 17: Whole System Service Delivery

<i>Instance 17: Whole System Service Delivery</i>	
Organization type:	Governmental
Date:	1997-2001
Presenting problem:	Develop Protocol for service delivery that integrates multiple disciplines and focuses on the victim (client).
Domain:	Community
Hypothesis:	System containers optimized work within disciplines, but interfered with cross-functional delivery and focus on the victim (client). Establishing new containers will encourage transforming exchange and emergence of integrated Protocols.
Condition:	Container
Intervention:	Multiple, including: <ul style="list-style-type: none"> • Cross-functional workgroups working on work products. • Focus on client needs, rather than various system procedures. • Development of a Protocol as a work product.
Outcome:	Included: <ul style="list-style-type: none"> • Protocols were developed and implemented. • New institute formed to disseminate the innovation to other locations.
Changed coherence Resolved presenting problem:	Yes

Background. The project, begun in 1997, was to establish a consistent Protocol for the investigation and prosecution of sexual assaults in all counties of the state. The project was funded by a federal grant from the Violence Against Women Act and was managed through the state Department of Corrections. The project was supervised and technical support was provided by personnel in one county. Their objective was to establish victim-

centered processes that would integrate the policies and procedures of various disciplines involved in investigation and prosecution of sexual assaults, including: community mental health, law enforcement, court system, victim advocates, and health professionals.

Conditions for Self-Organizing. Traditionally, the governmental systems and their disciplines formed the containers for service delivery. Each part of the system focused on its accountabilities and its formal relationships with others who provided service to the victim. In addition, service delivery was inconsistent across the state because history and political landscapes were different in each county.

Within the counties two primary differences were significant. First, the system representatives from medical, legal, and law enforcement fields were distinctly separated from the victims. They focused on procedure and policy, rather than the needs of individual victims. Second, the system representatives were, themselves, deeply divided. Procedure, values, political power, and jargon separated the attorneys from the police from the nurses from the psychologists. To meet the goals of the Protocol, all of these different constituencies would have to work together more effectively.

Traditional feedback loops between victim and system and among system representatives were formal. They depended on procedural hand-offs and legal requirements, roles, and responsibilities. Essentially, each of the system disciplines worked in a vacuum, and the victim had little influence on the path or the outcome of the investigation or prosecution processes.

Intervention. Rather than designing a rigid model Protocol to be implemented across the state, the project team decided to institute a process to help each county design a Protocol that would work in its unique environment. This critical project decision acknowledged that investigation and prosecution took place in complex adaptive system, and established the county as the container within which self-organization would take place. The state-wide project coordination would provide guidance and resources to support the work in each county.

Given that the differences within and between counties were so great, the project team defined interventions based on redefining the containers for decision making and action. The first container manipulation put the victim in the center of the process. Through a series of training sessions and data collection procedures, the Project Team helped focus the county's team on the victim and her needs. The second container intervention was defined by the required output of the process--a Protocol Document, which would determine how assaults would be investigated and prosecuted in the county (Boles & Patterson, 1997). The third and final container intervention established cross-disciplinary teams in each county. The team--usually 10 to 12 people--represented all of the system constituencies. This group worked together to define a common Protocol that all groups would follow.

Rather than working with all counties simultaneously, the Project team identified six pilot sites. These counties provided insights and learnings about the process and how it can be used to establish common working assumptions and procedures.

Over time, the pilot counties shared information with each other, developing a set of frequently asked questions and issues to be resolved during the development process.

Outcome. Given these conditions for self-organization, each pilot county developed its unique Protocol. All, however, depended on cooperation among system representatives of all areas and focusing the process on the needs of the victim. The products of the process, though varying widely in detail, all supported a victim-focused, interdisciplinary approach to investigation and prosecution of sexual assaults.

The work of the pilot counties served as experiments and opportunities for learning about the Protocol development process. Their findings will be documented in a Model Protocol, which will serve as a guide for other counties as they come together to generate the unique Protocols that best fit their unique environments. In addition a new institute has been formed to support research, legislation, and dissemination of about the new procedures.

Increased project-wide coherence, embodied in the Model Protocol and the institute, were results of the intervention that will, over time, extend the emerging coherence across the state-wide system.

Instance 18: Inter-Governmental Health care Planning

<i>Instance 18: Inter-Governmental Health Care Planning</i>	
Organization type:	Governmental
Date:	2000-2001
Presenting problem:	Inter-organizational group dissatisfied with process and outcomes.
Domain:	Community
Hypothesis:	Loss of common, urgent mission left the group without a coherent container. Work in a retreat setting will provide a container to articulate patterns of exchange and difference within the group and between the group and its outside partners to improve levels of satisfaction.
Condition:	Container, difference, exchange
Intervention:	Included: <ul style="list-style-type: none"> • Hold a one-day retreat to name mission of the group. • Establish small working groups to focus on specific issues. • Identify information-sharing time for every meeting.
Outcome:	Included: <ul style="list-style-type: none"> • The patterns improved for a short time, but deteriorated again. • County-level dynamics affected interactions and levels of commitment. • New members challenged working assumptions of the group.
Changed coherence Resolved presenting problem:	No

Background. In 1998, the state offered counties the option of providing their own health care plans to residents. This opportunity was welcomed by some, but it was confusing to

all. No county understood completely the risks and benefits involved in managing their own health care plans. In an effort to understand the issues, seven metro counties banded together. Human Service and Public Health Directors of the seven counties began to meet monthly to investigate the implications of the change and to share policy planning and communication resources.

Within a year, the counties had made their decisions about whether or not to offer their own health plans, and the immediate goal of the group had been met. Rather than disbanding, the group decided to continue to work together to investigate other health-related policy issues. In 1999, the group focused their energies on research in three health policy areas. Work groups collected, analyzed, and reported information to the group. By the end of the year, three white-paper reports were available for members to share with their County Administrations and Boards.

By January of 2000, the group had completed its research agenda. Their monthly meetings became more and more difficult. Without a clear focus or question, individuals used the meeting time to voice frustration, share news, and focus on individual or county-specific agendas. They decided to hold a one-day retreat to plan their activities for 2000 or to make the decision to disband the group.

Conditions for Self-Organizing. The purpose of the group had been an effective container for their first year. The research agenda had provided a sufficient container for small group work during year two, but the various projects had not been sufficient to provide a context for work of the group as a whole.

Three primary differences shaped the behavior of the group. First, each county had its own needs and administrative perspectives about health policy development and about collaborating with neighboring counties. Second, the group brought together representatives of health and human services. The concerns, language, and perspectives of these two disciplines, though related, are distinct in many ways. Third, all counties work closely with representatives of state agencies, especially the Department of Human Services and the State Department of Health. The differences between the state and counties in the definition and delivery of human services generated a level of frustration for individual county representatives that was voiced repeatedly in the group.

Another difference involved the identity of the group. The question was often asked, "What is unique about this group? What can we offer that is not available from other groups?" Upon analysis, the group articulated that this was the only group that represented metropolitan counties, integrated the concerns of health and human services, and focused on health care policy analysis and development. This combination of differences made the group unique, though other Inter-governmental associations focused on one or another of these domains: metro issues, health or human services, or health care policy.

The exchange loops supported by the group worked at three different levels. First, each meeting included the informal exchange of information among members. The meetings became an opportunity to find out what was happening in other parts of the system. For some members, this information exchange was helpful and constructive. Other members interpreted it as a gossipy waste of time. Second, the formal conversation during the

meetings dealt with internal policies and procedures within various counties.

Frustrations arose regarding the inability or unwillingness of some counties to participate fully in the activities supported by the group. Third, the meetings were used as opportunities to establish communications with state departments. Human Services or Health representatives would be invited to talk with the group. These conversations were frequently confrontational, though some members saw this limited communication as being better than none.

Intervention. During the one-day retreat, the group focused on its unique aspects and on its transforming feedback connections. In the course of the conversation, it became apparent that the group works in a massively entangled set of containers--county boards, county administrations, health, human services, policy, practice, state departments and divisions within departments. All of these complex relationships affect their work and the ability of the county to meet the needs of its citizens.

It was agreed that the group would continue. It established a new mission statement, a new name, and a new set of projects. Members decided that their most important exchange connection was with their own County Boards and Administration, so their projects would focus on issues that would require county action within the immediate future.

The group also wrestled with the competing priorities and restricted resources available for policy analysis. They determined to work within realistic bounds to accomplish their most high priority items.

Outcome. As a result of the retreat, the group decided that it needed professional facilitation for meetings and more structured interaction. Their expectation was that facilitation would reinforce their work as a group and constrain the individual differences that tended to disrupt progress toward their goals. Though the facilitation made individual conversations more satisfying for members of the group, it did not resolve two underlying issues.

First, though agreement had been made that the purpose of the group was to inform individuals and prepare them to make better decisions in their respective counties, some members of the group continued to express dissatisfaction that the group as a whole had no decision-making power.

Second, differences among the counties' internal missions and operating procedures continue to be an issue. Not all counties are equally committed to the process and substance of the planning processes pursued by the group.

Third, membership in the group has changed repeatedly as roles and responsibilities have been redefined for county personnel.

A year after the initial retreat and facilitated meetings, the group decided to focus on two activities. Work groups were formed to pursue two tactical issues, and meetings of the larger group focused on information exchange with the state departments. The level of dissatisfaction continues, and the group frequently strives to reassess its identity and mission. Though the group continues to meet, the level of coherence has not improved

significantly, and members continue to voice their dissatisfaction with the lack of cohesive or coherent group action.

Interventions and Outcomes Summary

Each of these eighteen instances represents a situation in which the client presented a problem for resolution, and the researcher articulated the problem in terms of the CDE Model, designed and implemented interventions based on the hypothesis, and evaluated the outcomes against the client's expectations. The following two tables summarize the data. Table 1 provides a summary of the instance characteristics. Table 2 summarizes the presenting problem and success of the intervention, hypothesis, intervention, and outcome for each instance.

Table 1. Summary of Instance Characteristics

#	Org.	Level	Date	C	D	E	Intervention	Success
1	Non-profit	Concept	1998-99	X			Work product	Yes
2	Informal	Concept	1998-01	X			Case study	Yes
3	Religious	Team	1994-98			X	Facilitation	Yes
4	Government	Team	1997	X	X	X	Future Search	Yes
5	Business	Team	1998			X	Training	No
6	Informal	Team	1999	X	X	X	Retreat	No
7	Non-profit	Team	1999-00	X			Retreat	No
8	Government	Team	2000-01		X		Facilitation	Yes
9	Non-profit	Institution	2000		X		Retreat	Yes
10	Informal	Institution	1995-96	X			Retreat	Yes
11	Religious	Institution	1998	X	X	X	Multiple	Yes
12	Business	Institution	1999			X	Meeting design	Yes
13	Business	Institution	1999			X	Process design	Yes
14	Non-profit	Institution	1999	X			Meeting design	Yes
15	Government	Institution	1999	X		X	Multiple	Yes
16	Non-profit	Institution	1999-00	X	X		Organization design	Yes
17	Government	Community	1997-01	X			Multiple	Yes
18	Government	Community	2000-01	X	X	X	Retreat	No

Table 2: Instance Summaries

Presenting Problem	Hypothesis	Intervention	Outcome
Concept Coherence			
<p><i>Instance 1:</i> <i>Research and Service Institute--</i> <i>Evaluation</i> Ineffective support for clients' design and implementation of evaluation systems. Success: Yes</p>	<p>Differences were clear, but exchange was unfocused. A work product (training and documentation) will form a new container to support client action and satisfaction.</p>	<p>Container Work product: Article and training guide</p>	<p>Individual learning for writers and clients Contribution to the field of program evaluation Improved client performance and satisfaction</p>
<p><i>Instance 2:</i> <i>Strategic Planning Study Group</i> Traditional strategic planning approaches do not reflect real policy planning processes in government. Success: Yes</p>	<p>Exchanges were rich and differences were clear, but the ambiguous container for the work led to minimal progress. Focus on a specific case will form a container that will improve the coherence of the project activities.</p>	<p>Container Case study: Focus on applications to a particular situation</p>	<p>Individual learning about CAS and organizations. Process for CAS-based policy planning designed and implemented.</p>
Team Coherence			
<p><i>Instance 3:</i> <i>International Religious Membership Organization</i> Task force focused on internal conflicts, rather than reaching stated objective--establishing new vision, mission, and structure for the organization as a whole. Success: Yes</p>	<p>Task force focused on internal conflicts, rather than reaching stated objective: to establish new vision, mission, and structure for the organization as a whole.</p>	<p>Exchange Facilitation: Establishing exchanges between the Task Force and the rest of the organization. Improving exchanges during Task Force meetings.</p>	<p>Consensus was reached within the Task Force on recommendations for the organization as a whole. Organization accepted recommendations from Task Force.</p>

<p><i>Instance 4:</i> <i>Inter-Governmental Think Tank</i> Build new energy in a diverse and sometimes contentious group. Success: Yes</p>	<p>Significant and generative differences within the group were not addressed because exchange processes were ineffective. No shared container held the group together. A temporary design that established container, exchange, and differences will allow the group to build a mission and vision for the future.</p>	<p>Container, difference, exchange Future Search to: Establish a coherent, though temporary, container Articulate the significant differences Support transforming exchange among members</p>	<p>The group identified a new vision and established work groups to implement its vision.</p>
<p><i>Instance 5:</i> <i>Financial Services</i> Supervisors and managers lack leadership skills. Success: No</p>	<p>In an organization with minimal exchange and extreme perceived differences between departments and organizational levels, training in complex systems thinking will improve managerial effectiveness.</p>	<p>Exchange Training: Design and pilot training for middle managers in systems thinking and complex adaptive systems design.</p>	<p>CAS training was rejected in favor of training on interpersonal skills for managers.</p>
<p><i>Instance 6:</i> <i>Health Care Think Tank</i> Concepts of complex adaptive systems can be applied to improve the effectiveness and efficiency of health care delivery. Success: No</p>	<p>A group of CAS and health care experts could propose a redesign of health care systems using principles of CAS. Exchanges across differences among health care and CAS experts in a retreat setting (physical and temporal container) would establish innovative solutions.</p>	<p>Container, difference, exchange Retreat meetings of experts provided: Time and space container for work. Focus on differences among participants Opportunities for transforming exchange</p>	<p>Individuals developed new ideas, Collaborations of small numbers of participants developed. Over time, the whole group collaboration dissolved without specific products</p>
<p><i>Instance 7:</i> <i>Restorative Justice</i> Group of community members unable to work together toward common goal. Success: No</p>	<p>Reinforcing the container would overcome destructive differences and disruptive exchanges.</p>	<p>Container Retreat to: Discourage conversation about group topics outside of group meetings. Reinforce shared values and visions. Focus the work of the group.</p>	<p>Differences were amplified. At the end of the retreat, the group dissolved.</p>

<p><i>Instance 8:</i> <i>County Library</i> Distrust of leader's ability in times of change. Success: Yes</p>	<p>Containers are clear, and exchange is frequent but unproductive. Articulating differences that make a difference will reestablish trust.</p>	<p>Difference Facilitation to: Articulate roles and responsibilities for all management levels Clarify decision-making processes.</p>	<p>Managers and workers expressed increased trust in leader. Cooperation and collaboration across the organization increased. Comfort with rapid and unpredictable change increased.</p>
<p><i>Instance 9:</i> <i>Environmental Training</i> Successful training company lacked sufficient infrastructure to expand, but values rejected traditional structure and power relationships. Success: Yes</p>	<p>Passion for and talk about a shared mission were insufficient to provide container and exchanges for a coherent organizational structure. Articulating differences will provide a structural foundation for expansion.</p>	<p>Difference Retreat to focus on: Differences that make a difference in the content of training and in the organizational structure. Differentiation of roles and responsibilities to perform necessary functions.</p>	<p>New, focused mission statement Clearer relationships with partners. Innovative organizational structure defined to meet new mission.</p>
Institutional Coherence			
<p><i>Instance 10:</i> <i>Study Group</i> Desire to merge two groups with similar missions and different memberships. Success: Yes</p>	<p>Differences between the groups were not significant, and the separate containers were historical artifacts. A temporary container with active exchange will allow the two groups to merge.</p>	<p>Container Retreat: Conduct a one-day retreat and invite members of both groups to participate.</p>	<p>At the end of the retreat, members suggested that the two groups be merged into one.</p>
<p><i>Instance 11:</i> <i>Regional Office of Religious Organization</i> Organizational culture inhibits integrated planning and delivery of services. Success: Yes</p>	<p>Tradition and history have established rigid boundaries and unproductive exchanges. Redesign of differences, patterns of exchange, and container will shift the organizational culture.</p>	<p>Container, difference, exchange Multiple, including: Define new organizational and committee structures. Redesign office space to be more integrated and fluid. Conduct SimuReal session to improve understanding across the institutional container. Develop and implement consistent meeting procedures.</p>	<p>Organizational silos weakened, but did not disappear. Changes within the organizational system allowed for more and better contact with outside constituencies.</p>

<p><i>Instance 12:</i> <i>Retail Creative Services</i> Creative and logistical teams do not work well together. Success: Yes</p>	<p>Business function provides a clear container, but differences in schedules, needs, and personal styles inhibit system-wide patterns of cooperation. More effective exchange patterns will allow diverse groups to function more effectively together.</p>	<p>Exchange Meeting redesign to: Include detail system reports as pre-work. Focus on action items and accountabilities around shared tasks. Encourage questions, rather than statements.</p>	<p>Specific long-standing issues resolved. Improved individual working relationships. Reduced tension at and between meetings.</p>
<p><i>Instance 13:</i> <i>International Mortgage Servicing</i> Diverse customer populations, wide variety of services, rapid technological and organizational change inhibit consistency and predictability of service quality. Success: Yes</p>	<p>No reliable container or clear differences can be defined for the group. Reliable transforming exchanges across organizational differences will increase consistency and predictability.</p>	<p>Exchange Process design: Identify communications manager to collect and distribute messages within and outside of the working group. Use diverse feedback mechanisms and cycles to respond to diverse and ever-changing information needs.</p>	<p>Increased cooperation and coherent action across the organization. More responsive and higher quality customer service.</p>
<p><i>Instance 14:</i> <i>Research and Service Institute-- Organizational Learning</i> Research, service delivery, administrative, and materials productions functions not integrated. Success: Yes</p>	<p>Departmental containers focus on differences between departments and restrict exchange across the system. Cross-functional teams will form new containers to encourage system-wide exchange and incorporate strategic differences into planning process.</p>	<p>Container Meeting design to: Establish cross-functional learning teams to focus on specific issues of shared, systemic interest. Reports from Teams to Executive Team to inform strategy and budget. Reports to staff to disseminate findings.</p>	<p>Process defined and implemented. Individuals developed relationships and understanding of others. Institution-wide strategies proposed. No policy impact because Executive Team refused to receive and act on reports of Teams.</p>
<p><i>Instance 15:</i> <i>County Social Services</i> Social service delivery fragmented and not responsive to clients. Success: Yes</p>	<p>Containers reinforced differences among departments and constrained exchange across boundaries. New, system-wide containers and formal transforming exchange opportunities will improve integration of services to clients.</p>	<p>Container, exchange Multiple: Establish over-arching objectives Provide structures for transforming exchange at various levels and purposes Facilitate interaction of leadership team</p>	<p>Improved individual and departmental willingness to work together. Multiple service delivery projects emerged. Integrative efforts initiated by workers. System-wide infrastructure components identified.</p>

<p><i>Instance 16:</i> <i>Liberal Arts College</i> Geographically separate units of single institution function as independent agents. Success: Yes</p>	<p>In spite of a strong shared mission (container) geographical and historical differences make transforming exchange difficult. Focus on an organization-wide administrative container will improve consistency and efficiency of administrative functions.</p>	<p>Container, difference Organizational design: Establish single Management Committee over whole institution. Distinguish between system-wide and local concerns and responsibilities. Articulate the significant differences between the two sites.</p>	<p>Improved and integrated administration of the whole institution.</p>
<p>Community Coherence</p>			
<p><i>Instance 17:</i> <i>Whole System Service Delivery</i> Develop Protocol for service delivery that integrates multiple disciplines and focuses on the victim (client). Success: Yes</p>	<p>System containers optimized work within disciplines, but interfered with cross-functional delivery and focus on the victim (client). Establishing new containers will encourage transforming exchange and emergence of integrated Protocols.</p>	<p>Container Multiple, including: Cross-functional workgroups working on work products Focus on client needs, rather than various system procedures. Development of a Protocol as a work product.</p>	<p>Protocols were developed and implemented. New institute formed to disseminate the innovation to other locations.</p>
<p><i>Instance 18:</i> <i>Inter-Governmental Health Care Planning</i> Inter-organizational group dissatisfied with process and outcomes. Success: No</p>	<p>Loss of common, urgent mission left the group without a coherent container. Work in a retreat setting will provide a container to articulate patterns of exchange and difference within the group and between the group and its outside partners to improve levels of satisfaction.</p>	<p>Container, difference, exchange Hold a one-day retreat to name mission of the group. Establish small working groups to focus on specific issues Identify information-sharing time for every meeting</p>	<p>The patterns improved for a short time, but deteriorated again. County-level dynamics affected interactions and levels of commitment. New members challenged working assumptions of the group.</p>

Data Analysis and Conclusions

The study supported the hypotheses:

H₁: Interventions that change one or more of the conditions for self-organizing (container, difference, exchange) change the coherence of the system.

H₂: Interventions that increase the coherence of one level of the human system increase the effectiveness of that organizational level.

Fourteen of the eighteen interventions resolved the presenting problems by increasing the coherence in the system of focus. Though the remaining four interventions did not successfully resolve the stated problems, coherence of the system was shifted in unanticipated ways or at unexpected levels.

In addition to responding to these initial hypotheses, the study generated a variety of insights about the ways in which container, difference, and exchange analysis and intervention influence the dynamics and coherence of human system interactions.

In each instance, the focus of the study was on the self-organizing dynamics within a situation (concept, team, institution, community) and within the situation on one or more of the conditions for self-organizing (container, difference, exchange). Selection of a domain and of a single condition of focus allowed the researcher to build coherent designs for intervention and evaluation. In reality, however, the naturally-occurring self-organizing dynamics within the system of focus and across the larger environments, which were massively entangled with the systems of focus, affected the path and

outcomes of the interventions. In addition, though the interventions focused on one condition or a set of conditions, the natural evolutions of the other conditions also affected the self-organizing processes. When observed patterns at macro- or micro-scales affected the path, speed, or outcomes of the self-organizing processes, analysis of the data takes into consideration the natural self-organizing patterns outside the system of focus and of conditions that were not the explicit focus of the intervention.

Unsuccessful Interventions

Success of the intervention is not solely determined by the selection of the condition for focus. Of the four unsuccessful instances, two involved all three conditions (6, 18), one involved exchange intervention (5), and one involved container interventions (7). All of these conditions proved successful in other instances, so no single condition or combination of conditions can be relied upon for predictable success across instances.

The interventions described in the instances constituted only part of the self-organizing dynamics that affected agents in the system. Because the instances existed in complex environments, other self-organizing processes at different parts of the system or at different scales influenced the tendencies of the system of focus to shift its systemic coherence. In the unsuccessful instances, self-organizing processes, counter to the intentions of the interventions, proved more stable than those within the scope of the study.

Instance 6: Health Care Think Tank resulted in individual learning and small-group development within the larger system, though the team as a whole ceased to exist after a short series of meetings. Participants talked about their "real life" work that was different

from the work of this temporary group. The periodic container established by the retreat settings was insufficient to overcome the diversity in the group, members' preoccupation with other activities, and their geographic dispersion. These confounding self-organized patterns were stable and resilient enough to disrupt the emergence of permanent system-wide coherence of the Think Tank as an entity.

Instance 7: Restorative Justice resulted in bifurcation of the system when transforming exchanges were not sufficient to hold the group together. Individual relationships were strengthened among some members, and individuals reported new personal insights, but the unproductive relationships among the members of the group were exacerbated by the intervention. The strong affiliations among some members and their aversion to other sub-groups were resilient in the face of the planned intervention.

Instance 18: Inter-Governmental Health Care Planning established effective working groups within the original group, which continue to function, but the group as a whole continues to wrestle with its system-wide coherence of shared vision and purpose. In this case, individual members participate in isolated institutional containers outside of the planning group over which they feel no control. Participation in self-organizing processes beyond the scope of the group were more influential in individual behavior than the emerging patterns of coherent behavior within the group.

In Instance 5: Financial Services, traditional patterns of difference and exchange were resistant to exchange interventions designed to create cross-system understanding and action. Though unable to resolve the presenting problem, this intervention did result in

individual learning, and new alliances among individual team members developed during the time of the intervention.

In all of these cases in which the interventions did not succeed in the original intent, other self-organizing dynamics (within the group or in other containers beyond the system of focus) were sufficiently strong to overwhelm the emergence of the new patterns that were the intended focus of the interventions.

Interventions that affect the conditions can shift the coherence of the system in unexpected ways or at unexpected levels. For example, Instance 7 strengthened relationships among sub-system members and contributed to individual learning, in spite of the fact that the system of focus dissipated after the intervention. Though the four unsuccessful interventions failed to resolve the presenting problems, they did result in changes in coherence at individual, macro-, or sub-group levels, as described above.

Three of the four unsuccessful interventions focused on coherence of teams (5, 6, 7). In all of these situations, coherence was increased at the sub-system level, with individual learning and/or increased affinities among individuals. The teams, as they were defined, however, ceased to function as intended. The fourth unsuccessful intervention (18), which focused on community coherence, also engendered increased coherence at sub-system levels in the form of work teams, though the system-wide coherence did not result from the intervention.

Three of the six team interventions (5, 6, 7) were unsuccessful, making the team interventions the least successful of the levels included in the study. Because three of the

six team interventions were successful, however, the CDE Model can be an effective approach with teams. The unsuccessful team interventions included in the study involved groups that had been brought together for a specific purpose across a variety of interests and perspectives. The teams met periodically, but the members remained tightly affiliated with their permanent organizational or professional environments. Though the members of the team participated in the functions of the interventions, the differences in their permanent loyalties made it difficult for them to participate in increasing coherence within the temporary team environment.

In all cases where the interventions were not successful, the intended system containers were emergent or not clearly sanctioned. This situation probably contributed to the fact that self-organizing dynamics beyond the confines of the intervention determined the long-range failure of the interventions to meet their stated goals. Instance 6 provided a physical and time-oriented container for the work of the team, but the system-wide coherence was not sufficient to be sustained between or beyond these infrequent face-to-face meetings. Instance 7 depended on a shared purpose for holding the system together, but fundamental values differences among the members led to disagreements about how the purpose should be accomplished. These underlying differences were too exaggerated to allow the team to work together over time. Instance 18 involved a community of institutions that had come together to solve a particular problem, but could find no other urgent common action to hold the whole system together.

These findings would indicate that a natural and strong container is required before coherence can be improved, but some of the successful interventions (4, 15, 17) also

lacked natural containers, and they were able none-the-less to move toward greater system-wide coherence. The difference seems to be not the absolute presence of competing containers but the relative strengths of those competing containers. In the unsuccessful instances, the competing containers were powerful determinants of behavior, while in the successful instances, the competing containers were less tradition bound and less coherent in themselves. This would indicate that the relative strengths of competing containers, rather than their presence, influence the success of interventions based on the CDE Model.

Successful Interventions

The fourteen successful interventions included a variety of organizational levels, conditions of focus, intervention methods, and organizational types, indicating that no one of these variables determines the success or failure of an organizational intervention based on the CDE Model. The influence of each of these variables as represented in the data is described below.

Organizational Levels

The data strongly indicate that CDE Model interventions are effective across organizational levels. In the study, the CDE Model was applied across four levels of human system organization: Concept, team, institution, and community. The success of the interventions varied from one level to another, but the CDE Model interventions proved successful in some instances at each level. Both concept coherence instances (1, 2) were successful. Of the six team instances, three were successful (3, 4, 8). All eight interventions at the institutional level were successful (9, 10, 11, 12, 13, 14, 15, 16). Of

the two community-level interventions, one was successful (17) and one was unsuccessful (18).

The eight institutional interventions that were successful (9, 10, 11, 12, 13, 14, 15, 16) included exchange only (12, 13), container only (10, 14), difference only (9), container and exchange (15), container and difference only (16), and all three conditions (11). The one intervention that blended container and difference (16) was also successful at the institutional level.

The conceptual coherence interventions (1, 2) focused on the container and shifting the container, and both were successful.

Conditions for Self-Organizing

Any of the three conditions can be used to design successful interventions. A variety of conditions and combinations of conditions were used in the successful situations. Five of the situations depended on container interventions to shift the coherence of the system (1, 2, 10, 14, 17). Three responded to exchange interventions (3, 12, 13). Two responded to difference interventions (8, 9). Interventions in the other successful situations involved a simultaneous change in multiple conditions: Container, difference, and exchange (4, 11); container and difference (16); and container and exchange (15).

Among successful interventions, the container interventions proved to be most consistently successful, with only one of the six instances failing to resolve the presenting problem (7). These instances involved a variety of methods to change containers, including focus on work products(s) (1), focus on specific situations or site (2), mixed

group meeting(s) (10, 14, 17). Two of these successful container interventions dealt with concept coherence (1, 2), two with institutional coherence (10, 14), and one with community (17).

Of the four interventions focused on exchange, both institutional interventions were successful (12, 13), but one of the two team interventions failed (5), and one succeeded (3). No conceptual or community interventions focused exclusively on exchange.

Of the two interventions that focused on difference, both were successful. One was targeted at the team level (8) and the other at the institution (9). In both of these cases differences questioning and amplification led the teams to establish internal structures that articulated and formalized inherent differences and supported the on-going work of the team.

Of the six blended interventions (4, 6, 11, 15, 16, 18), two of the four that used all three conditions were successful (4, 11). These interventions involved retreat settings, in which structured activities (SimuReal (11) and Future Search (4)) allowed the group to establish a functional laboratory to experiment with self-organizing of the group as a whole in a finite period of time. Of the four interventions that used blending of all conditions (4, 6, 11, 18), the two in retreat settings (6, 18) were not successful, while the ones that used formal Future Search (4) and multiple interventions (11) were successful. The other two successful blended interventions involved organization redesign (16) and multiple interventions (15).

Methods of Intervention

A variety of methods can be used successfully to influence the conditions for self-organizing. Focus on work products (1), case studies (2), facilitation (3, 8), Future Search (4), retreat (9, 10), meeting design (12, 14), process design (13), and organization design (16) all proved successful in CDE Model interventions included in the study. In addition, interventions that relied on multiple methods (11, 15, 17) also proved successful.

This does not indicate that any set of interventions would be appropriate in any situation. It is conceivable that a selected intervention might not only fail to resolve the presenting problem but exacerbate the underlying problems. One example of such an interaction appears in the unsuccessful intervention of Instance 7: Restorative Justice. Strengthening the container in this case constrained the system and exaggerated the conflicts within it. Exchange patterns, which were dysfunctional before the intervention, were amplified in the smaller container. The result was total dissolution of the group.

Based on the data it appears that successful interventions are those that build on the inherent strengths of the conditions for self-organization, and use those strengths to restructure the other conditions and the coherence of the emerging patterns.

Types of Organizations

The CDE Model is equally effective in a variety of types of organizations. The study included non-profits (1, 7, 9, 14, 16), informal groups (2, 6, 10), religious organizations (3, 11), government institutions (4, 8, 15, 17, 18), and for-profit businesses (5, 12, 13). The interventions were successful in all of these contexts, with only one unsuccessful

intervention in each of the categories of business, informal, and non-profit, and governmental environments.

Explicit References to CDE Model

In some of the instances, the researcher shared with participants the underlying theory and language of the CDE Model. In other instances, the model was used implicitly in analysis and design of the intervention, but participants were not explicitly trained on or introduced to the underlying theory. The decision whether or not to train participants in the model depended on the perceived or expressed interest of the client and the potential participants in the mechanisms or theory underlying the work. This variation appeared to have no appreciable affect on the effectiveness of the interventions. While a few participants in some groups expressed curiosity about the logic and structure of the interventions, most participants focused their attention on the immediate issues and concrete concerns and were not interested in the underlying mechanisms for change. The findings of the study indicate that the self-organizing processes shape the emergence of system-wide patterns whether or not the participants are conscious of the underlying dynamics.

Role of the Researcher/Consultant

Each of the interventions was designed prior to an encounter with the client system, but the intervention evolved in response to the behaviors of the participants. So, though the researcher/consultant might be seen as an external agent to the system (in which case the changes would not be self-organization but structure imposed by an external agent) he or she is intimately involved in the iterative design and implementation process in

collaboration with other system agents. Two factors affect the relationship of the researcher with the system and respond to this concern. First, with regard to the work of the client, the role of the researcher is to help shape the conditions for self-organizing, not to participate in the emerging patterns. By shaping the conditions, the researcher is able to amplify or accelerate the self-organizing processes, but the substance of the process and the outcomes are determined by the internal dynamics of the work group. Second, with regard to the design of the interactions, the researcher learns and shifts the intervention in real time. Because he or she is adapting and changing the design throughout the intervention, the researcher functions as more than just a catalyst in the process. By observing and interacting, the researcher is participating in the evolution of the conditions for self-organizing. In the domain of design, the consultant is an agent in the midst of the emerging dynamics, and like other agents, the researcher is equally influenced and has influence on the process.

In the course of the interventions, the researcher/consultant participated as an active agent in the interactions. As the interventions progressed through hours, days, or weeks, the conditions for self-organizing in the group shifted as well. As a conscious agent in the system, the researcher/consultant collected new information about the dynamics of the group and altered the intervention details to suit the emerging patterns. Though the gross scale of intervention definition in terms of the CDE did not change in the course of the intervention, as defined in the data descriptions, the emerging patterns at multiple scales shifted the focus and activities of the group through the active intervention of the researcher/consultant within the original framework of the analysis and intervention design.

Traditional Theory and Practice

In addition to investigating the role of self-organizing dynamics in human systems, the instances described in the study support some aspects of traditional organization development theory and practice. Work of organizational theorists have applied a variety of models and structures to describe the complex interactions and emerging behaviors of individuals, groups, and institutions. The CDE Model in no way negates this previous work. Rather, it articulates an underlying dynamical interaction that explains why traditional theory and practice are effective. As a unified theory, it may also provide a conceptual framework in which diverse theories and practices developed previously can be related to each other and to an overarching field of human systems dynamics.

Many examples in the data support traditional understanding of the behavior of individuals and organizations. For example, the instances suggest that positional leaders should be involved in systemic change efforts in organizations, that environmental factors and concerns shape the success of specific interventions, and that training and retreat interventions will be unsuccessful unless they are supported by preparatory and follow-up activities. Though not the focus of this study, the instances indicate that the CDE Model can serve to support and enrich traditional theory and practice without replacing the long-standing wisdom that has shaped the theory and practice of the past.

Summary of Findings

The study was designed to use the Results Reversal Method of inquiry, in which the researcher posits a hypothesis about a cause for dysfunction in a system, designs and implements an intervention based on that hypothesis, and evaluates the results. If the intervention based on the hypothesis is successful, then the hypothesis is supported.

This approach was used to investigate applications of the CDE Model in eighteen instances of change in human systems at conceptual, team, institutional, and community levels. In fourteen of the eighteen instances, the presenting problem of the client system was resolved. In the remaining four instances, the presenting problem was not resolved, but changes in the system were observed at non-targeted scales. Based on the instances described and analyzed above, the study supports the following insights regarding organizational interventions designed to shift the coherence of human systems using the conditions for self-organizing (container, difference, and exchange) in conceptual, team, institutional, and community settings.

The two hypotheses were supported by the data:

H₁: Interventions that change one or more of the conditions for self-organizing (container, difference, exchange) change the coherence of the system.

In all eighteen of the instances, shifts in the conditions for self-organizing affected the coherence of the system at one or more scales. In fourteen of the instances, the change in coherence was noted at the level of focus. In the four unsuccessful instances, changes in coherence were noted at levels of the system that were not the focus of the intervention.

H₂: Interventions that increase the coherence of one level of the human system increase the effectiveness of that organizational level.

The changes in coherence of the system did affect organizational performance in terms of the clients' presenting problems. In the successful instances (fourteen of eighteen), the clients' presenting problems were resolved in the course of the intervention. In the unsuccessful instances (four of eighteen), the organizational effectiveness, as defined by the clients' presenting problems, was not improved by the interventions.

In addition to supporting the stated hypotheses, other insights emerged from the study. They are summarized below.

- No single condition or combination of conditions can be relied upon for predictable success in all instances.
- Interventions that affect the conditions for self-organizing can shift the coherence of the system in unexpected ways or at unexpected scales.
- The relative strengths of competing containers influence the success of interventions based on the CDE Model.
- CDE Model interventions can be successful at various levels of organizational structure (concept, team, institution, or community).
- Any of the three conditions can be used to design successful interventions.
- Multiple intervention methods can be used to influence the conditions for self-organizing.

- CDE Model interventions can be successful in a variety of environments, including non-profits, government, for-profits, religious, and informal organizations.

This study has investigated how the CDE Model of self-organizing conditions for human systems provides a framework in which to assess organizational needs and design and implement interventions to meet those needs. The model was successfully applied in a majority of the instances studied, and further research will be required to investigate further applications and implications of the CDE Model for self-organizing human systems.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

Introduction

Human systems, including those involved in this study, comprise complex, often roiling environments where agents at different levels of organization interact to generate patterns of meaning and action. Scholarship and practice of the past have focused on individual levels of the system or on specific aspects of the interactions to build understanding of and competence within human systems. This study describes the emergence, application, and analysis of a model of meta-variables that shape the rates, paths, and patterns of self-organizing processes in human system that establish coherence across scales and domains.

The three meta-variables (container, difference, and exchange) that comprise the CDE Model, which is investigated in this study, shape the self-organizing processes in human systems. These meta-variables establish the conditions in which the complicated interactions of the components generate coherent patterns across the system and over time. The CDE Model provides an integrated, flexible, and simple foundation to support development of organizational theory, practical understanding of specific organizational contexts, and effective design, implementation, and evaluation of interventions intended to enhance the effectiveness of organizational processes.

The model and its implementation in organizational interventions provide insights that can affect how organizational change agents and leaders understand and work in complex adaptive human systems. This section describes the limitations of the study, identifies implications of the CDE Model for the practice and theory of organization development, and outlines questions for future research.

Limitations of the Study

This study uses the Results Reversal Method to investigate how changes in container, difference, and/or exchange conditions in a human system shift the level of coherence for that system. Limitations of the current study are described below.

All interventions were designed and implemented by the researcher. It is possible that the use of the CDE Model depends on the facilitator's style or other undefined characteristics. A variety of designs and interventions were included in the study to investigate the flexibility of the model in terms of intervention strategies. Also, a wide diversity of the sites and situations was included in the study to further test the generalizability of the CDE Model.

The sample is one of convenience--these organizations were available for investigation. It is possible that the organizations that presented themselves were predisposed to respond to interventions focused on changes to the container, difference, and exchange. The relatively large number of situations (18) were selected to reflect as wide a variety of situations as possible from the given population. From among an even larger population of situations, these were chosen to represent the widest range of presenting problems, interventions, and outcomes.

Institutional and team situations predominate in the data. One reason for this bias is that clients tended to define their presenting problems in terms of their teams or institutions. The data are more limited in applicability to conceptual, individual, and community interventions than to those for the team and the institution.

The interventions took place over a period of seven years (1994-2001). During that time the model evolved and became more refined, though the underlying principles were unchanged. In the early stages, as the CDE Model emerged, the analysis of the clients' systems and processes was post hoc, after the intervention and outcomes, the effects of the conditions on the client systems and the influence of the interventions on the conditions was apparent. Each intervention cycle added to the articulation and coherence of the emerging model, so the intentional analysis of the conditions and their use in intervention design was more conscious. In at least the final third of the instances, the CDE Model was used as a predictive tool to support design and implementation of interventions.

None of the situations presents a longitudinal view of changing coherence of the systems. The data focus on a finite number of strategies over a relatively short period of time in each instance. No claim can be made for the long-term or lasting effects of increased coherence noted during the period of the study.

As an initial investigation of the CDE Model the study focuses on a large number of interventions across a wide variety of organizational types and levels in order to explore the generalizability of the model. Given the large number of instances included, description of each individual instance is summary in nature. Detailed explanations of context, interdependencies, and personal and environmental variables that might have affected the work are not included in the instance descriptions. Explicit, thick description of situations and occurrences are beyond the scope of the current study. Effects of these rich interactions, however, are implicitly included in the study because the containers,

differences, and exchanges that are the focus of each instance description are dependent upon and closely coupled with emerging dynamics at environmental and individual scales not explicitly described in the instances.

Client perspectives are not explicitly included in the analysis. Session evaluations and self-report were included informally in the analysis, but clients did not function as co-researchers in the study.

Many of the interventions were planned and implemented with organizations in Minnesota, where the culture is relatively homogeneous and where individuals and institutions are recognized as "Minnesota nice." Other cultural contexts might generate different results.

Any human system can be understood to incorporate multiple and massively entangled self-organizing processes at any given time. Many naturally-occurring self-organizing processes precede, work simultaneously with, and continue after the intentional interventions described in the instances. These ancillary processes frequently appear as confounding dynamics in the investigation. The effort is made to articulate those influences when they are directly relevant to the outcomes of the intervention described in each instance.

Finally, a complex adaptive system, by definition, depends on an unlimited number of unpredictable factors. Without question, the observations and descriptions of the systems included in the narrative data exclude critical factors that helped shape the behavior of the systems. On the other hand, the study is designed to investigate whether or not the CDE

Model is able to capture system behavior at a meta-descriptive level, so that the infinite number of confounding variables can be integrated into the over-arching CDE patterns of self-organizing systems.

The current study is an initial investigation of the CDE Model. Given the limitations of the study, all findings should be considered limited in their generalizability. This initial investigation, however, provides a foundation for a new approach to understanding and intervening in the self-organizing processes of human systems.

Practical Implications

Many aspects of organization development have emerged as practices with conflicting or incoherent theoretical foundations. The CDE Model can provide a theoretical grounding to organization intervention that is simple, flexible, and generalizable.

The CDE Model provides an integrated foundation for the practice of organization development. It transcends the traditional conceptual and practical barriers that separate the field of organization development into groups who focused on change, or leadership, or team building, or diversity, or any of the other myriad approaches to the work.

Because the CDE Model involves meta-variables to describe the dynamics of self-organizing processes, it can be generalized across types of organizations, levels of organizational interaction, disciplinary languages, and cultural contexts.

In any specific environment, the local situation determines the system variables that serve the functions of constraining the system (containers), articulating productive tensions (differences), or establishing connections (exchange). Whatever the specifics of a given situation, the nonlinear and emergent dynamics of the CDE Model serve to describe the paths and products of the system as it emerges. The model establishes a framework in which client contexts and modes of practice can be compared and contrasted without losing the rich contextual information embedded in each.

The CDE Model supports all stages of organization development practice. Leaders and practitioners who plan and implement organizational interventions can use these findings

to assess the needs of their organizations and to design, implement, and evaluate the effectiveness of their efforts.

The conditions for self-organizing can be used to evaluate the readiness of a system for a new level of self-organizing coherence. The current states of the conditions for self-organizing and the stability of the previously self-organized structures will provide information about what interventions are likely to be successful in a given context at a given time.

Evaluation of an existing system can make explicit the functioning containers, differences, and exchanges that shape the current situation and its functionality. The assessment of current state will provide cues to which of the conditions might be changed to move the organization into different, coherent patterns of behavior. Then, interventions can be designed to address those most critical conditions for self-organizing.

In terms of evaluation, the CDE Model can also be used to define, measure, and investigate the characteristic of "organizational effectiveness." In a given situation, the containers, differences, exchanges, and level of coherence can provide insights into productive ways to operationalize the concept of organizational effectiveness. A metric of organizational effectiveness may be derived from the CDE Model and be applied broadly to multiple contexts. This approach will generate new ways to define organizational effectiveness and to articulate possible interventions that positively affect effectiveness of an organization internally and in relationship to the larger environmental system of which it is a part.

When designing interventions, professionals can focus on which of the conditions for self-organizing they wish to change and which to maintain. Possible interventions can be evaluated from the perspective of the conditions, forming a basis for selection of the most appropriate and potentially effective methods.

During implementation, practitioners can reflect on the evolving coherence of the group and take in-the-moment action to alter the intervention to meet the evolving needs of the group. The conditions for self-organizing can function as a rubric to track and reflect on the emerging coherence of a team. Each condition can be tracked independently or all can be tracked together to give an on-going sense of the emerging coherence of the group.

A simple procedure can help organizational practitioners use the CDE Model to improve the effectiveness of their interventions in complex and emergent situations. The procedure consists of questions about the self-organizing dynamics of the organizational entity. 1) Are the existing patterns of system-wide behavior consonant with the group's mission, goals, and environment? 2) If not, what are the containers, differences, and exchanges that have shaped the current patterns of behavior? 3) Which of the conditions is most available for influence given the stated needs and the time and resources at hand? 4) What intervention technique(s) will be most effective in influencing the chosen condition? 5) What are the effects of the intervention on the emerging patterns and on the active containers, differences, and exchanges? The final question brings the practitioner back to the first, and a cycle of transforming interaction can be repeated as new system-wide patterns emerge and as the practitioner becomes more proficient in interactions with the other system agents.

The data provided some practical suggestions for organization development professionals and change agents who wish to work with the self-organizing dynamics of their human systems.

- Analyze the loyalties of group members to other functional groups to anticipate how willing and able they will be to participate in the self-organizing processes within the system of focus.
- Consider the self-organizing processes at a variety of levels (conceptual, personal, team, institution, and community) and consider how processes at the other levels might affect the self-organizing dynamics in the system of focus.
- Assess the relative strengths of entangled and completing containers. Anticipate how the self-organizing processes in other domains will affect the behaviors of individuals within your system of focus.
- Design interventions that influence the most accessible of the conditions because a change in one will eventually lead to a change in the other two.
- Expect that changes at the system of focus will result in changes--personal and cognitive--at lower levels of scale in the system.
- Many different interventions will serve to shift the conditions for self-organizing in the system.
- Observe the self-organizing patterns as they emerge, and intervene in a timely way to shift the conditions in the course of the process.
- Be wary of interventions that depend solely on exchanges among system agents. These approaches will work most effectively when they are combined with interventions that also shift containers or differences for the system.

- Focus on differences between and among agents can be a powerful intervention for change in a system.
- Consider coherence as an indicator for organizational effectiveness and efficiency of your interventions.
- The effectiveness of an intervention is more dependent on the conditions for self-organizing that are affected than on the specific activities involved in the intervention.
- Use the CDE Model to assess or re-evaluate a change process as it progresses. When an intervention is not being effective, the CDE Model can provide information about alterations in the approach that may prove productive.

Theoretical Implications

In addition to its practical applications, the CDE Model opens an array of possibilities for theory development. This study has only begun to frame the questions that can establish a rich research agenda dealing with the conditions for self-organizing and how they appear in human systems. Further theoretical research will be required to articulate the conditions, their complex relationships to each other, and their influence over the emerging behavior of human systems.

The CDE Model may also have implications for development of human systems theory. Because the CDE Model is framed at the meta-variable level of abstraction, it supports integration of theoretical descriptions that have been factionalized by level of organization (individual, team, institution, community) by discipline (organization science, organization development, psychology, political theory) and by research method (quantitative, qualitative, simulation). The CDE Model establishes a foundation for asking new questions about the process of structuration in human systems at all levels and across all contexts. It can provide a common set of symbols and meta-variables that will allow theorists in a variety of fields to communicate coherently to compare and contrast their theoretical discoveries.

Computer simulation modeling, which has been instrumental in theory development in complex adaptive systems, may also benefit from the CDE Model. As a simple conceptualization of self-organizing system dynamics, the CDE Model can support design and development of computer simulation models that more nearly approximate the behavior of real agents in real systems.

In these three ways (supporting further research into its own implications, integrating theoretical developments across the field, and generating new computer simulation modeling approaches) the CDE Model can have wide-ranging theoretical implications for the field of complex adaptive processes in human systems.

Future Research Questions

This study is a preliminary investigation into the applications and implications of the CDE Model for self-organizing processes in human systems. Future research might fruitfully address a wide variety of questions about the CDE Model and its implications for organization development practice and theory.

How do the conditions for self-organizing influence the coherence of a system over an extended period of time? The current study focused on limited time periods and limited presenting problems. Because self-organizing is an on-going process and because system boundaries are multiple and massively entangled, the past and present conditions shape the future patterns of the system in unpredictable ways. Detailed case studies over extended periods of time will reveal how the conditions affect emergent patterns as they form and reform to support coherence and performance.

How do selected methods and facilitation styles relate to the conditions for self-organizing of the CDE Model? As an integrative model, the CDE provides a rubric to support comparative analysis of the variety of organizational intervention methods that are in use today. Some methods, such as large-scale interventions, manipulate the container to accelerate and shape self-organizing processes. Some, such as process redesign and cultural diversity, focus on differences that make a significant difference to the work of a group. Still others, such as decision-making and communication models, work with transforming exchanges to shift the coherence and performance of a system. Analysis of these techniques through the lens of the CDE Model may help practitioners

be more aware of their options and more conscious in their selections of effective interventions in specific situations.

What are the nonlinear relationships among the three conditions (container, difference, and exchange) over time? The interdependencies of the conditions is discussed in summary in this study, but a systematic analysis of the causal relationships among the conditions will provide additional insight into the mechanics of the self-organizing process. Though causality will continue to be indeterminate in complex adaptive systems, a more thorough understanding of the mutual causality of the conditions will help practitioners select interventions with conscious attention to their systemic and nonlinear effects. Ultimately it may be possible to articulate in mathematical equations the interdependencies between and among the conditions to provide a quantitative model for the emergence of self-organizing structures in complex human systems.

What variables commonly perform the functions of the conditions as meta-variables in various contexts (e.g., teams, functional departments, economies, industries)? In each situation, different variables perform the functional roles of the three conditions. Certain classes of situations, however, demonstrate similarities among the factors that form containers, differences, and exchanges. Future research might establish mid-level abstractions that define common containers, differences, or exchanges in various contexts. These situation-specific models will simplify the CDE Model for practitioners and accelerate the ability of a group to apply the conditions to manage their own self-organizing processes.

What is the effect of container, difference, and/or exchange interventions on super-systems, those that are larger than the system of focus, and sub-systems, those that are contained within the system of focus? Interdependencies among system levels and competing self-organizing processes were apparent in the instances described in this study. In general, change at one level influenced those at lower levels and was influenced by those at higher levels of organization. For example, individual learning and personal relationships were frequently strengthened by interventions, while examples of whole-system change beyond the scope of the intervention were rare. This outcome might have been an artifact of the study design, or it might indicate some directional causality in self-organizing of human systems. Further research will be required to investigate the possibilities for system change at one level to influence change at higher levels of the organization.

In what ways might the CDE Model be applied to programs that support the formation of individual identity, learning, and psychological health? This study focused on conceptual, team, organization, and community levels of development. In complex systems, however, patterns are repeated at many different levels and places. It is possible that intra-personal dynamics are conditioned by the CDE Model in the same way as inter-personal and organizational dynamics are affected. Further study might investigate how the CDE Model relates to theory and practice of self-organizing dynamics in psychology and cognitive development.

How does a group's self-consciousness about self-organizing dynamics affect its interactions and its potential to establish productive system-wide patterns? Experiences

documented in this study indicate that the dynamics of a group are altered by changes in the conditions for self-organizing, whether or not the group is aware of the conditions. It is also clear that some participants have intuitive understanding of the conditions without conscious knowledge of them. Further research could investigate the ways in which awareness of the conditions for self-organizing affect the subsequent performance of the individuals and the group as a whole.

What computer simulation modeling technique(s) best captures the emergence of a system based on its conditions for self-organizing? Complex adaptive systems are agent-based systems and have been successfully represented with a variety of computer simulation modeling techniques. Each of these models uses an underlying theory base to constrain the behavior of individual agents in the simulated space. The CDE Model provides a simple set of meta-variables that might be used as parameters for an agent-based or nonlinear dynamical simulation model. As well as supporting construction of effective and resilient models of human systems, this approach will operationalize and test the CDE Model in contexts that are more controlled than organizational situations.

Is the CDE Model applicable to self-organizing processes in physical systems? Research in the field of complexity and self-organizing in physical systems has emerged from various disciplines. To date, no integrative theory of emergent behavior has evolved that is equally applicable across disciplines or in different physical contexts. Though the current study is limited to the process as it appears in human systems, perhaps the conditions can be generalized to provide a coherent and integrated model for complex

adaptive systems behaviors when the agents have no conscious or rational awareness of their interactions and their environments.

In summary, the CDE Model provides a simple and generalizable framework to describe the emergent behavior of human collectives. Future research that applies the model in various real-world contexts will provide practical insights to support effective intervention in human systems. Future research that explicates and extends the theoretical implications of the model may provide an integrating theory base that brings together divergent explanatory models across a variety of disciplines that focus on the behaviors of humans in groups.

Conclusion

This study has introduced the CDE Model for the conditions that shape self-organizing in human systems and investigated how the model was used to assess, intervene in, and evaluate eighteen organizational development instances. This limited research sample has supported the hypothesis that the CDE Model is useful in studying and intervening in the complex dynamics of human systems. Future research will investigate the internal mechanics of the CDE Model and the role of such an integrated model in the theory and practice of self-organizing dynamics of human systems.

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