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Justin D. Walton

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Justin D. Walton
Cameron University

Organizations are among the most socially complex institutions within modern culture. As corporations face the challenges of technological change and globalization, it becomes essential that they find new ways and forms of fostering knowledge sharing and creativity. Challenging the age-old belief that employees should "dominated and directed," complexity theory challenges the classic machine metaphor of organizational structure with a view that conceptualizes them as nonlinear systems that fluctuate between conditions of stability and chaos. This model offers new and exciting opportunities for exploring the dynamics of organizational learning. Toward this end, this paper examines the systemic features of organizations with a particular focus on knowledge generation.

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Organizations are among the most socially complex institutions within modern culture. As corporations face the challenges of technological change and globalization, it becomes essential that they find new ways and forms of fostering knowledge sharing and creativity. Ralph Stacey (1992, 1995) argues that traditional emphases on standardization and control are no longer effective for managing organizational change within an increasingly interconnected global environment. Drawing on chaos theory and complexity science, he presents a view of organizational life that is in stark contrast to the classical principles of scientific management—one that portrays "organizing" as a dynamic, nonlinear process that fluctuates between conditions of chaos and stability. Challenging the age-old belief that employees should "dominated and directed," this theoretical approach challenges the classic machine metaphor, suggesting instead that organizations are nonlinear systems that fluctuate between conditions of stability and chaos. This model offers new and exciting opportunities for exploring the dynamics of organizational learning. Toward this end, this paper examines the systemic features of organizations with a particular focus on knowledge generation. I recommend that managers promote learning climates congruent with the systemic, relational qualities of organizations.

Organizations as Complex Systems

Advancements in quantum physics and physical science suggest that the Newtonian principles of linearity, prediction, and control hold limited understandings for the complexities of open systems. This paradigm shift, influenced by postmodernism, New Science and chaos theory renounces the reductionistic philosophies of Newton and Descartes in favor of a more ecological, interconnected worldview. Thus, systems thinking focuses on sets of relationships among interdependent, interacting forces:

> The basic tension is one between the parts and the whole. The emphasis on the parts has been called mechanistic, reductionistic, or atomistic; the emphasis on the whole holistic, organismic, or ecological. In twentieth-century science the holistic perspective has become known as "systemic" and the way of thinking it implies as "systems thinking." (Capra, 1996, p. 17)

From a systems perspective, relationships among objects are more meaningful that independent analyses of the objects themselves. Consequently, ecological thinking provides a rich framework for understanding the behavioral complexities of living systems and the transactional relationships they have with their environments.

Systems-based approaches are certainly not new for organizational theorists (e.g., Katz & Kahn, 1978; Weick, 1979; Thayer, 1968). In fact, Rogers and Rogers (1976) note that systems theory is one of three dominate schools of thought in organizational research (the others being scientific management and human relations). Most of these models rely heavily on Bertalanffy's General Systems Theory as of way of describing the interactive components of organizational behavior (e.g., leadership, networks, small groups, subsystems). However, recent developments in New Science have enhanced the theoretical assumptions of Bertalanffy's work:

> New science examines systems as self-generating, historical, contextual, relational, and interdependent. The emphasis on system relationship, the focus on transformative process, and the implicit notions of self-generation and creativity of the self-actualizing process are key components of the logic of systems underlying New Science. New Science, as described, may be a revolutionary way to approach and extend our understandings and how we interact with each other and in the world. (Fleener, 2002, p. 108)

In his book, Managing the Unknowable: Strategic Boundaries Between Order and Chaos in Organizations, Ralph Stacey (1992) argues that organizations exhibit such features—i.e., organizations are dynamic systems which generate unstable, nonlinear patterns. This proposition implies that organizations have unpredictable long-term properties that develop through irregular periods of chaos, which in turn, produce new self-organizing structures. Consequently, attempts to control the long-range direction of organizational change is bound to fail.

Organizations, as nonlinear feedback systems, exhibit qualities of complex adaptive systems (Stacey, 1992, 1995; Pascale, 1999). Consequently, one relatively small alteration can have substantial impacts on the rest of the system. Complex systems also display self-organizing qualities. Drawing on Wheatley, Stamp (1997) notes that the dynamics of a complex adaptive system add inherent indeterminacy to patterned unfoldings. This order emerges out of complicated feedback fluctuations and adaptive networks. Capra (1996) reasons that:

> Because networks of communication may generate feedback loops, they may acquire the ability to regulate themselves. For example, a community that maintains an active network of communication will learn from its mistakes, because the consequences of a mistake will spread through the network and return to the source along feedback loops. Thus the community can correct its mistakes, regulate itself, and organize itself. Indeed, self-organization has emerged as perhaps the central concept in the systems view of life, and like the concepts of feedback and self-regulation, it is linked closely to networks. The pattern of life, we might say, is a network pattern capable of self-organization. (p. 82-83)

For this reason, managers must pay particular attention to organizational feedback. Nonlinear systems operate by two basic forms of feedback loops—negative (stabilizing) and positive (amplifying). Negative feedback allows a system to maintain a state of equilibrium while positive feedback, in its purest form, pushes a system toward extreme instability. Stacey (1992) contends that it is the interface of these two feedback boundaries that creates a third condition, namely chaotic behavior. This behavior becomes bounded instability as contradictory forces create unpredictable patterns of creativity. For this reason, managers working within the new paradigm "must create, invent, and discover their destinations as they go" (Stacey, 1992, p. 4). The framework for such an endeavor is innovative strategic direction.

Factors Relevant to Knowledge Generation and Organizational Learning

Creative Expression

Creativity and innovation supply energy for organization change and innovation. Unfortunately, traditional managerial perspectives can hamper these processes. Regularity and uniformity keep systems in states of equilibrium (negative feedback), which are often reinforced by the accustomed principles control, measured decision-making, and unified visions.

In a chaotic framework, organizations driven to a "far-from-equilibrium" state result from the creative energies released in self-organization. As Stacey (1992) emphasizes, creativity is generated and released as systems transition through dialectics of stability and instability:

> In chaos then, creativity is a potentially ongoing process that is internally generated in a spontaneous manner. It is neither proaction according to some prior design nor reaction to environmental change, but rather continu-

ing interaction with other systems in the environment. A system in this state creates its own environment and its own future. (p. 83)

From this perspective, creativity is not something "decreed" (or even a material "thing"), but rather a natural outcome of the system's ongoing interchanges (between stability and instability) and reciprocities with its environment (i.e., structural couplings).

The imaginative processes connected to creativity are co-created in informal group networks. These spontaneous forming groups emerge from natural communicative interaction and have no centralized core governing their actions. Through dialogue, unstructured brainstorming, and critical questioning, these groups self-organize to deal with strategic issues.

Interpersonal Spaces

A number of strategies exist for knowledge generation and transfer. Most invoke the value of small group dynamics and interpersonal conversation. For example, Davenport and Prusak (2000) recommend managers supporting various types of "talk communities" in which physical space and time are set aside for employee dialogue. Cafeterias, and break rooms are two illustrations. Groups can also self-organize by common interests (i.e., "communities of practice) by regularly communicating reflections, impressions, and ideas via email, conversation, and memorandums. Another possibility entails sponsoring knowledge fairs and forums where a variety of groups (from different levels) interact in real-time, face-to-face venues to discuss innovative concepts and research subject. Idea sharing and problem-posing have both systemic and intellectual value; for this reason, managers should not view "talk time" and casual interchange as a waste of time, but rather as a natural property of dynamic innovation. Opportunities for knowledge generation and sharing should be encouraged by reinforced throughout all levels of the organization.

Conflictual Learning

Many view conflict as an uninviting consequence of interaction. In actuality, conflict has a meaningful role in learning dynamics:

> The important point is that, far from being harmful, the instability of multiple cultures and conflict around issues and careers, as well as lack of cohesion, consensus, and commitment, is vital to the continual provocation of new perceptions and ideas. In a successful organization this instability is bounded, not explosive. (p. 95)

Drawing on Senge, Stacey (1992) emphasizes the importance of "double loop learning" over "single loop learning." Single loop learning is characteristic of most group problem-solving models; a problem is identified, alternatives are considered, and a solution selected. In contrast, double loop learning fosters imaginative contemplation, as well as innovative discovery. Double loop learning is a process that can be encouraged, but not necessarily measured or regulated.

Facilitating a Constructive Climate

Managers can promote encouraging climates in which they exert "influence by operating on the boundary conditions surrounding the learning process in the organization, that is, the context within which it occurs" (Stacey, 1992, p. 164). In an eight year study of group dynamics, Gibb (1961) found six behaviors that contributed to supportive climates: (a) descriptiveness, (b) collaboration, (c) spontaneity, (d) empathy, (e) equality, and (f) provisionalism.

Conclusion

Complexity theory offers new and exciting opportunities for the study and practice of organizational learning. This paper examined the systemic features of organizations with a particular focus on knowledge generation. Specific implications are made concerning elements of management, principles of organizational structure and communicative attitudes, and knowledge management.

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Dr. Justin Walton is an Associate Professor of Communication Studies at Cameron University in Lawton, Oklahoma. He completed his undergraduate education at Oklahoma State University and received his M.A. and Ph.D. from the University of Oklahoma. He frequently teaches coursework in presentational speaking, small group dynamics, research methods, communication theory, and multicultural communication. His scholarly interests include critical approach to communication pedagogy, citizenship education, and instructional leadership. In addition to his teaching and research, Walton serves as the department's mentor for students concentrating in communication education.