Circuitous Path to Organizational Systems

Systems Theory Application

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Introduction

The study of organizations is a recent phenomenon. Until the 1940s and 1950s organizations were not independently considered outside the primary, discipline-centered area of study (e.g., politics, economics) (Scott, 1998). Much has changed.

Today scholarly literature is rich with avant-garde organizational theories replete with explanations from the physical and natural sciences (Eidelson, 1997; Gregersen & Sailer, 1993; Mathews, White, & Long, 1999). Some purport that the complexity sciences – chaos theory, nonlinear dynamic systems theory, the theory of self-organization, and dissipative structures (Mathews et al., 1999) – provide the framework for looking at organizations in new ways (Okes, 2003). To fully understand organizations it is necessary to incorporate into the exploration tools of these "new sciences" (Vinten, 1992). Understanding the power of the organizational system may have been neglected (Perrow, 2000); however, the organization today may constitute a revolution in social structure (Scott, 1998). It is far from neglected.

This paper will explore the dual foundational underpinnings of organizational analysis: systems and social theories. Their parallel, evolutionary paths led, what some contemporary scholars believe to be, to the current problem in sociology (Scott, 1998), namely, organizations. It will conclude with the basic exploratory framework of organizations as complex adaptive systems, including an introduction of complementary complexity sciences and the management aspects of them.

Overview: The Parallel Paths of Systems and Social Theory

Bertalanffy reminds us that Aristotle taught “the whole is more than the sum of its parts” (1972). This is a foundational concept of systems theory, and, as some attest “rather advanced systems thinking for the time” (Skyttner, 1996, p. 16). While originally very philosophical in nature, this concept makes “pragmatic sense” (Scott, 1998, p. 94), as well. It is also, as Bertalanffy suggests , the basic systems problem: complexes of elements standing in interaction among themselves and the environment (see discussion 1969, p. 33; 1972, pp. 416-417) which, as a whole, has distinct properties including being goal seeking and regulated (Skyttner, 1996).

However, science has for nearly 400 years fostered a view that understanding does not come from an analysis of the whole, but rather by studying the “play of elementary units governed by ‘blind laws of nature’” (Von Bertalanffy, 1969, p. 30). As explored in the essay, *Quantum Mechanics and Neuroplasticticity: An Elementary Examination of the Interrelationship,* the classic view of physics suggests a purely deterministic world (expanded discussion in McElroy, 2004). It holds that tiny “mindless” particles, acting much like billiard balls, react with each other void of man’s conscious intervention. Acts are, then, fixed by physically described conditions and controlled by mechanical laws. Western science has made “unbridgeable” the divide between the world of mind and that of matter and, consequently, fostered a non-systems approach to science. It is why science has split into innumerable disciplines and sub-disciplines (Von Bertalanffy, 1969) suffering from fragmentation and overspecialization (Bailey, 1994).

The force creating this near four century irreconcilable chasm sprang from the contradictory 17th Century views held by René Descartes and the church. Descartes argued that there were two parallel domains of, what became know as, the “Cartesian dualism” (Schwartz &

Begley, 2002): 1) mind, whose essence is thought, where every event is *cogitatio*, or a content of experience (Chalmers, 1996) and 2) the material world (see McElroy, 2004, pp. 33-34). Dualism, or the macro-micro issue in sociology, continues to plaque theorists (Layder, 1994).

Even in Newton's time scientist recognized that he did not "embrace all aspects of the physical world that were then known" (Polkinghorne, 2002, p. 1). Issues left unaddressed included the nature of the universal inverse-square law of gravity. Issues which received only speculative conjecture from Newton included the particle nature of light (later discovered to exhibit wave properties, as well). These unsettled issues, even in the late 17th century, "threatened belief in the self-sufficiency of the Newtonian synthesis" (Polkinghorne, 2002, p. 1). While Newton's achievements were "imposing," they left unanswered questions and, more important, clearly indicated that his fundamental premise of the mechanical nature of reality was incorrect. This view simply did not allow for an understanding of conscious experience. It left, conversely, problems of "wholeness, dynamic interaction and organization" (Von Bertalanffy, 1969, p. 31). Bertanlannfy contends that problems of "systems" remained "philosophical" and did not become a "science" (1972, p. 411) due, primarily, to the inability for mathematical expression.

Early in the 20th century doubts arose about the 'paradigm' of classical science (Von Bertalanffy, 1972). Powerfully illustrating this, the years 1925 and 1926 witnessed two major discoveries that started the "quantum revolution:" The German Werner Heisenberg (1901-1976) and his matrix mechanics and the Austrian Edwin Schrodinger and his wave mechanics. These two seeming dissimilar discoveries were later recognized as a "single theory" (Polkinghorne, 2002, p. 20) differing only in mathematical expressions (see discussion McElroy, 2004, pp. 9-11). Quantum mechanics was born. The "old" science of explaining complex phenomena in terms of isolatable elements was untenable (Von Bertalanffy, 1972, p. 410). Some believe that it constitutes a “micro-Dark Age” brought on my faulty ontological assumptions (Mandel, 2004).

Similarly, social theory has been locked in conflict over the macro-micro issue or “dualism.” The roots of this issue may, as well, rest with Decartes. Descartes argued that there were two parallel domains of mind and the material world (McElroy, 2004). The church, perceiving a threat from scientific advances, orchestrated a division of the two (usually through threat of physical violence). Science readily ceded the soul and conscious mind to religion. This is understandable given Descartes argument that matter is subject to scientific inquiry while mind and consciousness are not. Science retained the material world (see general discussion Schwartz & Begley, 2002, pp. 31-35). It is interesting to note that some believe that centuries after his assertions that Descartes became the “laughingstock of scientist” for his dualist views (Pinker, 1997). Dualism precluded a rigorous examination of the interrelationship of the two; the link between psychological mind and phenomenal mind continues to be ill understood (Chalmers, 1996). The development of a holistic organizational systems perspective would diverge from parallel paths, one in systems theory and one in social theory (Bailey, 1994). Social theory, struggling with dualism, split further into multiple camps: functionalism, humanists rejecting dualism, those rejecting dualism and totally abandoning the terms of social theory, and those affirming dualism but strive to forge links (see Figure 1). From these numerous theories emerged.

General Systems Theory

Foundation

The systems concept was not “born yesterday” (Von Bertalanffy, 1972, p. 408), but rather has a long history (Kast & Rosenzweig, 1972; Skyttner, 1996; Von Bertalanffy, 1969) and "rich genealogy" (Kast & Rosenzweig, 1972) (see Table 1). As early as the 6th Century a systems concept was understood. In that time Lao Tzu discussed systems design (Mandel, 2004). 'Systems' thinking may have roots even further back, in man's earliest culture (Von Bertalanffy, 1972). Man in a hostile environment found an "intelligible order" in nature. Aristotle later developed a metaphysical vision of hierarchic order in this (Skyttner, 1996).

Table 1. Early Contributors to Systems Thinking

Time	Contributor	Concept
6th Century B.C.	Lao Tzu	Systems design (Mandel, 2004)
3rd Century B.C.	Chinese	Yin/Yang (Mandel, 2004)
1400's	Nicholas of Cusa	*Coincidentia oppositorum*, the opposition among the parts within a whole which forms a unity of higher order (Von Bertalanffy, 1969;, 1972)
1600's	Gottfried Leibniz[1]	*Mathesis universalis* foreshadows an expanded mathematics which is not limited to quantitative or numerical expression and is able to formalize all conceptual thinking (Von Bertalanffy, 1972)
1812	Hegel	Science of Logic (Kast & Rosenzweig, 1972; Skyttner, 1996)
1900	Ferdinand de Saussure	Ideas led to "structuralism"(Skyttner, 1996)
1912	Alexander Bogdanov	Russian philosopher, theory of universal organizational science (Kast & Rosenzweig, 1972)
1926	Jan Smuts	Boer general, book: Holism and Evolution. Influential forerunner of systems movement (Skyttner, 1996)

The 16th Century scientific revolution replaced the descriptive-metaphysical concept with a mathematical-positivistic one (Von Bertalanffy, 1972). Descarte in *Discours de la Methode* suggested that every problem should be broken down into as many simple elements as possible. Science, then, deals with order or organization based on experiences and operations known before 1850 (Kast & Rosenzweig, 1972) in two fundamental ways (Von Bertalanffy, 1972):

1. Comparison with man-made machines as with Descarte *bete machine* and Lamettrie *home machine*.
2. Natural selection, Darwinian idea.

However, "self-maintaining" systems are not provided for by ordinary laws of physics, specifically the 2nd law of thermodynamics (Von Bertalanffy, 1969). This law states that "ordered systems in which irreversible processes take place tend toward most probable states and, hence, toward destruction of existing order and ultimate decay" (Von Bertalanffy, 1972, p. 409), toward maximum entropy and disorder (Bailey, 1994, p. 148). However, Bertalanffy argues that the "order of a whole… is a fact of observation" (1972, p. 408). Systems, in fact, do not naturally move toward total destruction. Thus the dilemma: How could the organizational complexity that clearly existed in living systems be explained without contradicting the second law (Bailey, 1994)?

Background

There are numerous thinkers who made introductory contributions to systems theory, for example Dionysius the Aeropagite, Nicholas of Cusa, and Leibnez (Von Bertalanffy, 1969;, 1972). Later, others made foundational contributions, such as Wiener (cybernetics, 1948), Shannon and Weaver (information theory, 1949), and von Neuman (game theory, 1947) (Von Bertalanffy, 1972). And still later "founders" of systems theory made significant developmental contributions, for example Rapoport, Miller, Mead (Bailey, 1994) with Boulding, and Ralph Gerard (Von Bertalanffy, 1969). However, the introduction of General Systems Theory (GST) is generally attributed to Ludwig von Bertalanffy (Bailey, 1994; Mandel, 2004). No one espoused this more than Bertalanffy.

Bertalanffy asserts that he first solely introduced "the idea" (Von Bertalanffy, 1969, p. 11) of and placed the "germ" (Von Bertalanffy, 1972) for general systems theory. It is interesting, however, to see that history does not consistently place him singularly in this role. Some suggest that Bertalanffy was, with Boulding, "one of the founding fathers" (Banathy, 2004), while others suggest that he was one within many (Bailey, 1994; Skyttner, 1996). Even a contemporary, exploring application of General Systems Theory, did not reference Bertanaffy. He did, however, mention Boulding (Kast & Rosenzweig, 1972). Systems theory, as Bertanaffy suggests, may be not so much a discovery as it is a general, evolving recognition of reality. Bertalanffy suggested this when he stated relative to systems theory, "ideas are in the air" (Von Bertalanffy, 1969, p. 15).

Systems

To qualify as a system it must display continuity of identity and goal directedness (Skyttner, 1996). This, in a material-sense, foreshadows sociological-centered systems aspects. As will be examined in a later section, Talcott Parsons suggests "functional prerequisites" for a social system, including goal attainment (Osborne & Van Loon, 1999). Skyttner list ten properties of systems as he discerns them from General Systems Theory (1996, pp. 4-5):

1. Interrelationship and interdependence[5];
2. Holism;
3. Goal seeking;
4. Transformation process[5];
5. Inputs and outputs;
6. Entropy;
7. Regulation[5];
8. Hierarchy;
9. Differentiation;
10. Equfinality and multifinality[5].

There are, however, many definitions for systems. Bertalanffy defined it as "complexes of elements standing in interaction" (1969, p. 33) and, in later works expanding the interaction to include the environment, "a set of elements standing in interrelation among themselves and with the environment" (1972, p. 417). Some define systems more broadly. As Weiss suggests, a system is "anything unitary enough to deserve a name," and Boulding as, "anything that is not chaos" (Skyttner, 1996). Most, however, subscribe to Bertalanffy's basic definition. Miller defines system as "a set of interacting units with interrelationships among them," Parsons as "a general or fundamental property of interdependence of parts or variables," and Hall and Fagen as "a set of objects together with relationships between the objects and between their attributes" (Bailey, 1994). Kenneth Bailey, founder of Social Entropy Theory, suggests that there are distinct similarities in the various definitions of system (Bailey, 1994). They are:

1. Specify some basic units of the system;
2. Specify connections;
3. Specify or imply that relationships are nonrandom;
4. Allow the existence of boundary;
5. Allow or presume existence of environment outside of the boundary.

Concept

The emergence of complex systems brought about the realization of the need for new scientific thinking (Banathy, 2004), constituting, in General Systems Theory, as suggested by Bertalanffy, a "second industrial revolution" (1969, p. 4). It is a "reorientation of scientific thinking" (1969, p. 5), and a "broad shift in scientific perspective" (1969, p. 17). While Newtonian physics searched deeper into the elemental constituent parts (Feynman, 2001; McElroy, 2004; McEvoy & Zarate, 1996; Polkinghorne, 2002; Stapp, 1993), the emerging world-view from modern physics can be characterized as organic, holistic, and ecological (Mandel, 2004). It embraces, then, the whole.

General science, however, can be characterized as ever-increasing specialization (Banathy, 2004), split into innumerable disciplines (Von Bertalanffy, 1969), suffering from excess fragmentation and over-specialization, "hyperspecialization" (Bailey, 1994). Many similar problems and, consequently, similar discoveries were duplicated among these "isolated" disciplines, "encapsulated in their private universe" (Banathy, 2004, p. 2). This was a primary concern for Bertalanffy. He believed that one could transfer principles from one field to another so that it would no longer be necessary to duplicate the discovery of the same principles in different fields (Mandel, 2004, p. 3). One of the chief goals of systems theory is to expose and avoid such duplication of effort (Bailey, 1994; Von Bertalanffy, 1969). Other goals of systems theory include, as espoused by Bertalanffy (1969, p. 38):

1. Integration in the various sciences, natural and social;
2. Such integration to be centered in general theory of systems;
3. Such theory may be an important means of aiming at exact theory in the nonphysical fields of science:
4. Unity of science;
5. Integration in scientific education.

Current State

Discussion in the 1950s and 1960s, relative to the importance of systems, referenced "enormous strides" in physics (see Von Bertalanffy, 1969, pp. 5-6), namely quantum mechanics. While quantum mechanics deals primarily with single "quantum elements" (see Feynman, 2001; Schwartz & Begley, 2002, pp. 284-286; Stapp, 2001), it leaves unexplained the relationship with other quantum elements. Some argue that this realm of exploration "falls naturally in line with… sciences in which a regular pattern blends with their evolutionary history" (see Von Bertalanffy, 1969, pp. 5-6). Further research, then, will have to explore the possibility of quantum systems. A basic question that should be addressed in such research: Could "self-organization" display the basic principles of a "quantum systems?" In that systems trigger behavior at critical junctures and, once they have done so, cannot return to their original pattern (Von Bertalanffy, 1969, p. 9), could the employed mechanism be the collapse of the probability wave determining the system state as prescribed by quantum mechanics? Could the classic wave-particle paradox demonstrated by the double-slit experiment[2] be explainable in quantum systems theory?

Social Theory

Foundation

While Plato prescribed how society should be organized some 2,500 years ago (Osborne & Van Loon, 1999), the first systematic study of society is attributed to Ibn Khaldun, a 14th Century Tunisian government administrator and scientist (McWilliams, 2004). While Auguste Comte is credited with coining the term "sociology" (Osborne & Van Loon, 1999) and generally considered the founder of sociology (McWilliams, 2004), some argue that Compte actually contributed little to the eventual development of sociological theory (Swartz, 1999). Most accept that the birth of sociological studies occurred within the science and philosophy of the 'Great Enlightenment' of the 18th Century (Osborne & Van Loon, 1999).

Sociology is fundamentally about understanding how society works (Osborne & Van Loon, 1999). It is the study of the structure and functioning of groups (Myers, 1987), of human social behavior (McWilliams, 2004). Current sociology is in a confusing state with contradictory evaluations. Some believe that sociology is at a "dead end" (Black, 2000) simply repeating old ideas, while others believe that it is thriving (Haverman, 2000). Still others consider sociology of "increasing maturity" (Maines, 2000), growing, expanding, and accepting new concepts. However, challenging the very "science" of sociology, some suggest that it is a "science with the most methods and the fewest results" (Henri Poincare, see Osborne & Van Loon, 1999, p. 101). It is understandable why some believe that "there can be no eventual great synthesis in social theory" (Layder, 1994, p. vi), in that it is the most general and most difficult of human sciences (Osborne & Van Loon, 1999). Theorists, it is evident, cannot agree on the state or viability of the very theoretical infrastructure within which they work. As with General Systems Theory that suffers from splintering, where scientists "derive their particular system" (Mandel, 2004, p. 2) making a case for the need for a new, modified, or expanded "general systems model," sociology has "begun to unravel" (Osborne & Van Loon, 1999). More and more areas of society and culture demand specific study. Sociology continues to become a confused and complex array of different theories. Perhaps, as Ilya Prigogine highlights in his question "…social evolution shows us the complex emerging from the simple. How is this possible?" (Prigogine, 1984, p. xxviii), understanding of society is not in the examination of the parts (including isolated and, perhaps, biased, views of discreet dynamics), but rather in the whole. As Scott suggests, "No complex system can be understood by an analysis that attempts to decompose the system into its individual parts" for examination (Scott, 1998, p. 93). Perhaps ultimate understanding of social functioning lies in the realm of systems exploration in chaos and complexity.

Parsons' Functionalism

The closest that sociology has come to a complete consensus of theory is in the work of Talcott Parsons (1902-1979) and his theory of functionalism (Osborne & Van Loon, 1999), ideas which continue to be held in high esteem (Layder, 1994). Parsons, the man, as well is held in high esteem with contemporary sociologists. He is considered a "towering intellectual figure" (Fox, 1997), "the king" (Osborne & Van Loon, 1999, p. 92) during the 1940s and 1950s. He was responsible for educating sociologists for three generations. Many consider Parsons works challenging to read and understand (Lewis, 2002), frustrating and "productive of headaches" (Layder, 1994, p. 13). However, his writings continue to be explored. Contemporary social theorists persist in developing Parsons' theory (Example, N. Luhmann, see Lewis, 2002, p. 799) as he is considered the most influential of functionalist theorist (Layder, 1994). His most influential work, *Structure of Social Action*, was published in 1937 (Wrong, 2001) and is one such source for contemporary scholars.

Parsons believed that society is made up of independent parts that function together. This is comparable to Bertalanffy's assertions relative to General Systems Theory (Von Bertalanffy, 1969). When the parts function well together, society functions properly. He believed that these parts are, within a society, institutions or structures (McWilliams, 2004). Further, that all institutions have a purpose within society (Osborne & Van Loon, 1999). It is this relational functioning, bringing about "equilibrium" in a social system and the foundational notion underlying self-regulating systems, that was a fundamental concept in Parsons' functionalism.

There were three main influences to Parsons, theorists championing different theories of society: Herbert Spencer, Emile Durkheim, and Max Weber. This influence can be seen in the major themes of Parsons' functionalism (general discussion of the development of Parsons' framework, see Layder, 1994, pp. 13-15):

1. Relation between individual social behavior and the social environment (Emile Durkheim influence, see Collins, 1994, p. 200; Layder, 1994, p. 14; Osborne & Van Loon, 1999, p. 88);

2. Social evolution (Herbert Spencer influence, see Osborne & Van Loon, 1999, p. 30) (see also Spencer's supporting ideas relative to equilibrium Bailey, 1994, pp. 94-96);
3. Nature of the relation between institutions (Max Weber influence, see Collins, 1994, p. 201; Grusky & Miller, 1981, pp. 98-109; Layder, 1994, p. 14).

Again, Parsons' basic thesis is that society is comprised of independent parts or "organs" (McWilliams, 2004) which must be considered as functioning in a "social system as a whole" (Collins, 1994, p. 200). Considered the "original systems theorist" (Bailey, 1994, p. xiv), Parsons emphasized that individual activity (behavior) is a function of social systems (Layder, 1994). His argument relative to this relationship is one significantly differentiating him with earlier Marxist beliefs. As an example, while Marx argued that capitalist society is exploitive and, thereby, fundamentally conflict-ridden (Bailey, 1994; see especially Collins, 1994, pp. 49-56; Layder, 1994), Parsons believed that capitalist society is a fair and "meritocratic system" (Layder, 1994, p. 14).

He explained, in his version of functionalism, that there are four "prerequisites" (Osborne & Van Loon, 1999, p. 89) or "needs" (Layder, 1994, p. 18) for the survival of a society. More abstract than other sociologists, he described these prerequisites in "picturesque metaphors" (Collins, 1994, p. 200) equating society's functions to a "living organism" (Layder, 1994, p. 18) (*e.g.,* brain, digestive tract).

1. Adaptation – How a social system adjust as a function of the environment in which it operates. Maintaining a state of "equilibrium" is possible when changes in an area of a system have consequential and correcting actions in other system areas (*i.e.,* adaptation) (Osborne & Van Loon, 1999, p. 90) (see for discussion of

"equilibrium" Bailey, 1994, pp. 88-106). This is fulfilled by society's economy – money (Layder, 1994);

2. Goal attainment – Creating direction for the members of society by establishing social objectives. Goal attainment within a system, to a larger system in which it is part, is little more than a specialized function (see discusion Grusky & Miller, 1981, p. 100). This is fulfilled by society's political system – power (Layder, 1994);
3. Integration – Maintaining social cohesion, core values. This is fulfilled by society's legal and informal controls – influence (Layder, 1994);
4. Pattern maintenance – Reproducing society in order to propagate values. This is fulfilled by society's socialization – commitment (Layder, 1994).

Criticism of Functionalism

There are many criticisms of functionalism (see general discussions Bailey, 1994, pp. 77-84; Layder, 1994, pp. 22-32). Functionalism's chief critic may have been Robert K. Merton (b. 1910), a student of Parsons. Leaving Parsons tutelage when he was recruited to Columbia University in 1944 (Wrong, 2001), Merton "put his finger on the basic fallacy of functionalism" (Osborne & Van Loon, 1999, p. 95): the myth of coherence. He explained the three main problems with functionalism as:

1. The postulate of indispensability – tautological paradox whereby a social institution's function is explored with the existing base assumption that it does have a function which, in itself, satisfies the exploration.
2. The fallacy of functional unity – faced with evident contradictions to this notion, functionalism was forced to adopt a dual explanation of function: latent and

manifest. Behavior has a “manifest” function whereby the action is taken for a conscious reason, for “results that people consciously try to attain” (Collins, 1994, p. 198). Behavior also has a “latent” or “hidden” (Osborne & Van Loon, 1999, p. 96) function which are “produced by the social system itself” (Collins, 1994, p. 198).

3. The postulate of universal functionalism – asks the question, “does everything have to have a function?” (Osborne & Van Loon, 1999, p. 97).

Two other frequent and major criticisms of functionalism are the “overemphasis upon structure” (Copeland, 1997) while underemphasizing function (or action) and the reliance on equilibrium.

The Macro-Micro Debate

The macro-micro, or dualism, debate in sociology has been around as long as sociology itself. Different schools of social theory have assumed various positions relative to the debate in order to deal with it (Layder, 1994). Functionalist firmly believe that dualism exists, centering the theories on the dominance of macro analysis.[3] Humanists reject dualism and others (*e.g.*, Foucault, Elias, and Gidden) contend that dualism is a mistake (Layder, 1994). These theorists assume a micro analysis[4] stance. The beliefs about a macro-micro linkage covers a wide spectrum. Some believe that no linkage exists (Mouzelis, 1993), others believe that a distinct link exists in various dimensions (Kalleberg, 1989), while others propose sophisticated models for linkage (Mealiea & Lee, 1979). While the debate has been impassioned, it has led “precisely nowhere” (Mouzelis, 1993, p. 680). The macro and micro aspects of sociological theory are “intimately related to each other” (Layder, 1994, p. 1); however, some contend that the debate is at a “theoretical impasse” (Mouzelis, 1993, p. 675). As Scott contends, “the micro-macro divide

… tends to unduly segregate" work focused on individuals from that focused on the organization (Scott, 1998, p. xiii). This may be a consequence of dealing with a complex social system operating in a nondeterministic environment, forced or limited to concentrate on an aspect of the system because of the inherent difficulty understanding the "whole" of the system. The solution, then, may not be the development of a theoretical synthesis, especially considering that many believe that no synthesis is possible (see Layder, 1994, p. vi), but rather use modern technology: current computer modeling capability.

Mulitagent systems (MAS) is a new computer simulation technology (see in-depth exploration in Sawyer, 2003). This technology is believed to be valuable in sociology in that it allows the study of the macro-micro relationship through simulation. Simulation is "the most widely employed technique" (Scott, 1998, p. 93) for analyzing complex systems such as that presented in corporate social behavior. These computer simulation systems contain numerous autonomous "agents," that have control over their own behavior. Created by the advent of microprocessors and "other computer tools" of the Information Revolution (Axelrod & Cohen, 2000), these systems can model "social phenomena" (Sawyer, 2003, p. 330), including corporate reorganizations and strategy shifts in the business world (Axelrod & Cohen, 2000). Researchers in this field contend that "the model is the theory" in that "theories are abstracted models that are evaluated in terms of their fit with empirically observed data" (Sawyer, 2003, p.332).

In-Depth: Organizational Systems Theory

Emerging Field of Inquiry

Tracing the genesis or organizational studies is difficult. Charles Perrow declares that the origin is tied to the increasing appearance of business schools in the late 1950s and 1960s (2000). Scott offers two dates of origin for organizations as a distinct field of sociological inquiry: to the period of late 1940s (1998, p. 8) or after 1950 (1998, p. 29). Shenhav argues that the genesis of the organizational systems paradigm can be traced back even earlier, to the period 1879-1932 (1995). We are left, then, with the vague and confused chronological record for the birth of organizations as a distinct field, the study of which is suggested as the "current problem in sociology" (Scott, 1998, p. 3).

The impetus to consider organizations as a discrete discipline, similarly, is not uniformly agreed. Perrow, as mentioned earlier, correlates the emergence of organizational studies to the consequential appearance of business schools. Scott, that they are inextricably linked to military systems and sports teams. Shenhav contends that they are a result of 19th Century engineering practices[6] and the coincidental alignment of "1. the efforts of mechanical engineers who sought industrial legitimization, 2. the Progressive period's rhetoric on professionalism, equality, and progress, and 3. labor unrest" (1995, p. 557).

Regardless of the date of its emergence or the impetus for its birth, the field of organizational studies holds that large organizations have, by supplanting the family business, produced a "revolution in social structure" (Scott, 1998, p. 4). They have become the most powerful force in industrialized societies (Perrow, 2000), harnessing the power of vast resources (Fritz, 1996). Perrow goes so far as to attest that "all important social processes either have their origin in formal organizations or are strongly mediated by them; the study of organizations must be at the core of all social science (Perrow, 1986).

Organizations as System

Contemporary organizational scholars contend that there is a "growing tendency to replace the traditional static [organization] model with one that views the organization as a system" (Nadler & Tushman, 1997, p. 26), cybernetic (Scott, 1998) or social (Morgan, 1997). Bertalanffy espoused, "in order to understand an organized whole we must know both the parts and the relations between them" (1972, p. 411). A fundamental premise explained in current organizational design literature, reflecting Bertalanffy's contention, is that organizations are systems (see for example Galbraith, 1995; Lawler, 1996; Nadler, Gerstein, & Shaw, 1992; Nadler & Tushman, 1997). Most explicit of the contemporary organizational scholars in this assertion are David Nadler and Michael Tushman (see 1997, pp. 26-28). They assert that "social organisms" display many of the same characteristics as mechanical and natural systems, namely that these social organizations exhibit relationships among constituent elements or parts. Echoing basic discussions of element relationships from systems theory and social theory, particularly that of Talcott Parsons (see earlier sections in this manuscript "General Systems Theory", p. 7; "Social Theory", p. 13), Nadler and Tushman (1997) list five interrelated characteristics of the organizational system[5]:

1. Internal interdependence;
2. Capacity for feedback;
3. Equilibrium;
4. Alternative configuration;
5. Adaptation.

Basic characteristics of an organization suggests “system” (for expanded discussion see Scott, 1998, pp. 17-23). Scott suggests three as fundamental: 1. structure (Scott, 1998, p. 17) (complementary views see Bailey, 1994; Von Bertalanffy, 1972), 2. goals (Scott, 1998, pp. 20-21) (complementary views see Skyttner, 1996), and 3. relationship with the environment (1998, p. 21) (see complementary views Axelrod & Cohen, 2000; Von Bertalanffy, 1972).

Complex Adaptive Systems

Contemporary organizational scholars acknowledge that organizational systems are, in fact, complex systems (Perrow, 1999). Managers will have to “rethink” organizations, embracing complexity (Morgan, 1997). Senge, as an example, cautions managers to incorporate complexity into their operational routines (1990). Others, more constrained with their reference to complex systems, nonetheless construct much of their organizing principles on the foundational concepts of systems and complexity theories (Fritz, 1996; Galbraith, 1995; Lawler, 1996; Lowenthal, 1994), specifically that organizations are made up of complex array of interrelated elements and that it is the pattern of interactions that is vitally important. As an example, Nadler et al. explains that organizations are “constructed of components that interact” (Nadler et al., 1992). This is reflective of Bertalanffy’s belief that a system is comprised of a “set of elements standing in interrelation among themselves and with the environment” (1972, p. 417) and the evolving recognition that “widespread complexity” exists in organizations (Murphy, Ruch, Pepicello, & Murphy, 1997) (see also Adler, Black, & Loveland, 2003; Murphy et al., 1997; Naikar, Pearce, & Drumm, 2003; Plesk & Wilson, 2001; Vinten, 1992). The “new science” perspective of complex organizational systems (Vinten, 1992) suggests:

1. They are non-linear;
2. They have a large number of components;

3. They are rarely closed;
4. Complexity appears abruptly.

This work holds, as mentioned earlier, that a systems perspective of organizations stems from observations that they display many characteristics in common with mechanical and natural systems (Nadler & Tushman, 1997). Most of these scholars and practitioners, argue that these elements, and more important that their interactions, must "fit" (see especially Lawler, 1996, pp. 45-53), be "congruent" (see especially Nadler et al., 1992, pp. 51-56)[7], and exhibit "balance and consistency" (Nadler & Tushman, 1997). It is important, then, to assume the perspective of "systems thinking" (Senge, 1990) relative to one's exploration of and understanding of the complex interactions of the organization's constituent elements.

As Senge explains, "systems thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years, to make the patterns clearer, and to help us see how to change them effectively" (1990, p. 7). Systems thinking, putting the system within the context of the larger environment, fosters an analysis that includes the system as an element of a larger whole (Gharajedaghi, 1999). Senge specifically explains that "Systems thinking is a discipline for seeing the wholes" (1990, p. 68). The field of systems thinking is comprised of multi-discipline analysis practices, including cyberntics and chaos theory; gestalt therapy (Senge, Kleiner, Roberts, Ross, & Smith, 1994); complexity theory (Gharajedaghi, 1999); and systems theory (Fritz, 1996). It is, then, a more comprehensive means to look at the whole. The body of knowledge constituting systems thinking has, as explained by Gharajedaghi, undergone three distinct developmental stages in its fifty year history (1999, pp. 15-16):

1. Operations research – challenges of interdependency in the context of mechanical systems;

2. Cybernetics and open systems – dual challenges of interdependency and self-organization in the context of living systems;
3. Design – triple challenge of interdependency, self-organization, and choice in the context of sociocultural systems.

Contemporary organizational theorists also acknowledge the need for a "new science" (Gharajedaghi, 1999; Miller, 1998; Vinten, 1992) perspective to understand complex organizational systems (see Fritz, 1996, pp. 90-92). Complex systems, conversely, may have brought about the realization of the need for new scientific thinking (Banathy, 2004). This view can be characterized as organic, holistic, and ecological (Mandel, 2004), taking, as Bertalanffy asserted over 30 years ago (1969; 1972) and Senge as recently as 1994 (1990; 1994), that understanding systems, including social systems, requires an holistic view.

Such a recognition validates Bertalanffy's three decade old assertion that that there needs to be a broad shift in scientific perspective in order to understand any system; organized complexity is "alien to conventional physics" (Von Bertalanffy, 1969, p. 34). Much of the work in this field of "new science," however, predated Bertanffy's declaration. This left the student of systems exposed to the need for a different perspective, but without the discoveries and synthesis that, at that point, remained in the future.

Complexity Sciences

Complexity sciences (Mathews et al., 1999), providing a general (Okes, 2003) and popular (Adler et al., 2003) framework for analyzing organizations is a young science (Gregersen & Sailer, 1993). Collectively composed of various concepts (including chaos theory, see Mathews et al., 1999), complexity has "enormous implications" (Morgan, 1997) and, therefore, warrant consideration in the continued endeavor to better understand organizations.

Chaos Theory

Dealing with complex organizational systems, armed only with yesterday's theories, fostered a comfortable approach of elemental analysis; researchers look at isolated elements of the whole (reductionism, see Feynman, 2001; Fuchs, 1967). Understanding the whole operating in a nondeterministic environment in incomprehensible resultant patterns was too difficult. Theorists and practitioners of yesterday found unintended consequences of micro-level individual behavior leading to unexpected macro-social outcomes (Sawyer, 2003); they found, "doing the obvious thing does not produce the obvious, desired outcome" (Senge, 1990, p. 71). What was being evidenced was the "Butterfly Effect"[8] of chaos theory (see Gleick, 1987, pp. 9-32). Also called "sensitive dependence on initial conditions" (Gleick, 1987, p. 8), the "Butterfly Effect" is a reference to a phenomenon in chaos theory where a small change to the input causes large changes to the output. The mathematical process of 'iteration' where feedback is reinitiated into a nonlinear system can lead to profoundly different outcomes given very similar inputs (Warren, Franklin, & Streeter, 1998).

Chaos theory is gradually taking the scientific establishment by storm (Vinten, 1992). Twentieth Century science will be known for three things: relativity, quantum mechanics, and chaos (Gleick, 1987). Gleick recounts that James Yorke gave the science its name in his paper "*Period Three Implies Chaos*" (1987, p. 69); however, Edward Lorenz discovered the phenomenon in his 1960s exploration of weather. His paper "*Deterministic Nonperiodic Flow*" is oft-cited relative to discussions of chaos. Throughout the 1960s chaos was considered an "untested discipline" and not, therefore, well accepted. It failed to generate widespread interest and application (Eidelson, 1997). In the 1970s news about chaos came as an "electric shock" causing a "paradigm shift." Finally, emerging in the late 1980s (Gregersen & Sailer, 1993), there was general “academic diffusion” of chaos theory (Gleick, 1987). Today, some researchers encourage the “immediate and all-encompassing incorporation of the complexity sciences” including chaos theory into organizational analysis (Mathews et al., 1999). Fully embracing chaos theory, some researchers suggests that in the 21st Century “companies will no longer be effectively managed by rigid objectives or instructions” (Dolan, Garcia, & Auerback, 2003). However, one reason for the earlier “resistance” to chaos theory was the confusion with its basic definition (Eidelson, 1997). The problem remains today.

Chaos theory has not been adequately defined (Mathews et al., 1999) and, therefore, lacks a standard meaning (Ditto & Munakata, 1995). It is an “interdisciplinary ‘Tower of Babel’” (Eidelson, 1997, p. 42). While Gleick admits that no one can quite agree on the definition of chaos (1987, p. 306), he nevertheless provides seven examples, including “… ubiquitous class of natural phenomenon,” “… random recurrent behavior,” and “… systems liberated to randomly explore their every dynamical possibility” (1987, see p. 306). As well, there is no general introductory text on chaos for the social scientists (Warren et al., 1998). Chaos, or Nonlinear, theory in the social sciences is only now being developed. Scholars, particularly those focused on organizations, with a fresh intellectual concept may prove pivotal in the ultimate understanding of organizational dynamics.

Complexity Theory

One of the “new sciences” becoming a popular framework for organizational analysis is complexity theory (Adler et al., 2003). Where chaos is the “science of process” (Gleick, 1987) primarily dealing with situations (circumstance or condition such as turbulence), complexity deals with systems (organization or arrangement) “composed of many interacting agents”

(Axelrod & Cohen, 2000, p. xv). Complexity theory is the study of behavior of macroscopic collections of units that are endowed with the potential to evolve over time (Murray, 1998).

However, complexity theory is not an independent supposition of isolated phenomenon, but a eclectic notion encouraging the incorporation of all the "complexity sciences" (Mathews et al., 1999). "Complexity theory," then, includes nonlinear dynamic systems theory, non-equilibrium thermodynamics, dissipative structures, the theory of self-organization, catastrophe theory, the theory of self-organized criticality, antichaos, and chaos theory (Mathews et al., 1999). How these various theories comprehensively work together to form universal principles of organizational dynamics is only generally conceived. The fundamental concepts of this science are young and evolving. Considered across many levels of abstraction, described variously as "structure" (Axelrod & Cohen, 2000; Okes, 2003), "dynamics" (Eidelson, 1997), and "principles" (Murray, 1998), authors site similar constituent aspects of complexity theory. Critical to the notion seem to be the primary aspects of:

1. Distributed control (Eidelson, 1997; limited, see Okes, 2003; no central control, see Wah, 1998);
2. Robust feedback (shorter-term, finer-grained measures, see Axelrod & Cohen, 2000; flexible and redundant, see Eidelson, 1997; sufficient with multiple sources, see Okes, 2003; non-linear, see Wah, 1998);
3. Strong linkage/network (reciprocal interaction, see Axelrod & Cohen, 2000; absolute number and strength/frequency, see Eidelson, 1997);
4. Small changes (tiny perturbations, see Ditto & Munakata, 1995; Okes, 2003).

Management in Complex Systems

The “new sciences” concepts of chaos and complexity theories have infiltrated management theory (Vinten, 1992). Recent discourse suggesting such is seen relative to training programs (Adler et al., 2003), nursing (Miller, 1998), leadership (Plesk & Wilson, 2001), and general management (Vinten, 1992).

The path taken in exploration of organizations and the resultant management principles, however, did not include the notion of “new science.” Rather, it was channeled by and formed management guidelines in accordance with the concepts of reductionism, behaviorism, and functionalism (Layder, 1994; Morgan, 1997; Perrow, 1986; Scott, 1998). The expanding horizon of organizational theory, which incorporates new and evolving concepts, is a rich scholarly field. However, the manager has to “manage” today. Steeped in the tradition and knowledge of “proven” management theory, these managers and now faced with incorporating fundamentally different concepts into daily practice. “For learning organizations, only when managers start thinking in terms of the systems archetypes, does systems thinking become an active daily agent, continually revealing how we create our reality” (Senge, 1990, p. 95) It must be, much as the old adage suggest, like changing a tire on a moving car. While “new science” thinking has integrated the realm of management theory, some are reluctant to accept it (Murray, 1998; nuclear industry, see Perrow, 1999).

Managers are encouraged to “cope” with (Vinten, 1992), “embrace” (Plesk & Wilson, 2001), and commit to and influence general acceptance of (Senge et al., 1994) complexity. Recognizing that such an exercise causes tension and anxiety (Plesk & Wilson, 2001), there is little instructive advice on how the manager should accomplish this. Mangers are faced with and need to respond to ever-increasing levels of uncertainty (Vinten, 1992). Embracing complexity allows for a "new and more productive management style to emerge" (Plesk & Wilson, 2001). Some argue that one rationale for managers' reluctance to embrace complexity may be the resulting "blurring of functional distinctions" (see Murphy et al., 1997, p. 35) and the resultant degradation of efficiency. It is, then, based on productivity. Others suggest that it produces inhibiting tension and anxiety (Plesk & Wilson, 2001). It is, then, based on psychological states and emotion. Regardless of source, recent interest in the complexity sciences relative to management suggests that managers will have to overcome their reluctance toward complexity (see for example Ditto & Munakata, 1995; Dolan et al., 2003; Okes, 2003; Wah, 1998). The need for and difficulty in altering leaders' belief system during organizational change, including the aforementioned attitudes toward complexity, have been explored (see for example McElroy, 1999).

Conclusion

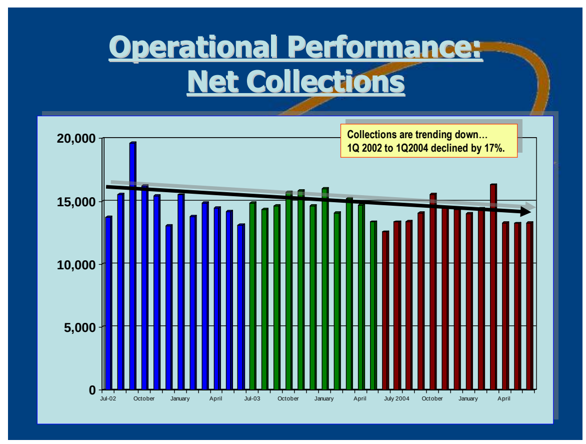
This paper explored the foundational underpinnings of contemporary organizational analysis, including systems and social theories. It culminated in the exploration of the present-day recognition that organizations are complex adaptive social system. Both rich fields have critically contributed to contemporary understanding of the dual pillars of organizations. Organizations are influenced, then, by the mathematically-modeled properties of inanimate systems as well as the phenomenological, "lived" social dynamic. This combination requires the organizational scholar/practitioner to simultaneously understand the manifest dynamic from the scientific perspectives of material/corporeal/physical as well as social/psychological. Complicating the task further is the recent recognition of universal laws that are applicable to the understanding of organizations that are not explained by classic or "Newtonian" physics. These "new sciences" will significantly influence organizational analysis well into the future.

With the relatively recent consideration of organizations as an independent discipline (1940s-1950s), and the discovery of chaos and the complexity sciences in the 1960s, only in the the 1980s and 1990s have modern scientific concepts, the "new sciences" been brought to bear on the topic. Much remains to be discovered. Many authors call for continued research in this area (Gregersen & Sailer, 1993; Wah, 1998), leading to a "rigorous, internally consistent, and empirically adequate theory" (Mathews et al., 1999). We do so here. Some are advocates for "broader implementation and evaluation" (Eidelson, 1997) suggesting an "immediate and all-encompassing incorporation of the complexity sciences" including chaos theory into organizational analysis (Mathews et al., 1999). "Chaos and complexity theory will add to the texture of social science and social work for years to come" (Warren et al., 1998). The understanding of organizational systems will surely benefit.

Applied: Organizational Systems Change – A Witness Perspective

I have a unique position to observe organizations. As a business consultant, currently working with blood banks throughout the US and Canada, I have had the opportunity to review organizations without hindrance; I have had complete access to all information. While confidential in nature, pertinent work is explained here for the purpose of this paper.

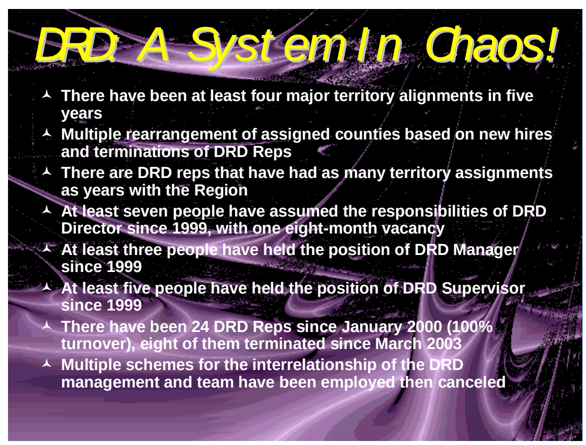
I was recently engaged to perform a two-week pre-intervention analysis of an operation where management questioned their DRD (Donor Recruitment Department) performance. This non-profit blood bank utilizes two sources for donor recruitment: DRD (sales-oriented personal business solicitation) for mobile drive operations and Telerecruiting for the recruitment of



donors to the organization's "fixed site" operations. I found, as management indicated and as depicted in the above graph, that there was a strong rationale for this question. Overall performance (mobile and fixed site operations), as measured by net blood units collected, had steadily declined during the last three years. The trend shows an alarming continued negative decline. In fact, we found that in this three-year period that performance had declined by some 17%. This net unit decrease represents approximately an annual revenue loss of $500,000. Such a decline in revenue while maintaining expenses at the pre-decline level is having a significant impact on the blood banks fiscal solvency. The blood bank was correct to seek advice on ways to re-strengthen operations. However, their initial focus was incorrect.

The blood bank management viewed the organization very mechanically, functionally. The Recruitment Department (comprised of both DRD and Telerecuiting), much like the supply department of traditional manufacturing company, is responsible for the “supply of raw material,” the blood donor. If, in their minds, overall performance had declined so significantly the problem must center on DRD. DRD at this blood bank is responsible for 85% of the total net annual collections.

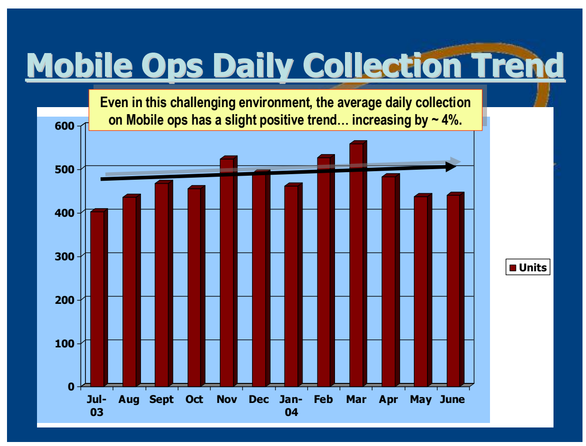
What I found was an organization in chaos. There was amble evidence of organizational decline, organizational change, and crisis management, suggestive of an inherently discontinuous transformational phenomenon (see Gregersen & Sailer, 1993). Some of the findings are presented below.



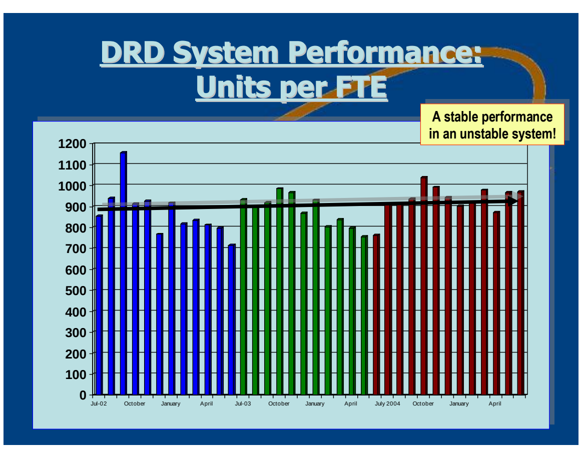
- With “churning” of leadership and management, there has been a chaotic shift of expectations, direction, and policy
- While most of the tools seem to exist, they are not uniformly understood or used by DRD Reps nor keenly understood and expected by management
- DRD Reps exhibit skill, dedication, and desire to do the job… they suffer from lack of consistent leadership
- Information flow and communication to DRD Reps are inadequate
- Feedback to and support of DRD Reps are inadequate

- There is little or no training and coaching for the DRD Reps
- Territory alignment is imbalanced (opportunity and goal).

The "edge of chaos" is a place of increased innovation and adaptation. Theorists suggests that an organization too tightly structured or if too chaotic it cannot "move." Between the two extremes is a point at the "edge of chaos" where adequate structure exists to hold people and processes together, yet enough flexibility to allow enhancement (see Wah, 1998). It is at this point, as Morgan suggests, that the point operates much as a "fork in the road" (1997, p. 265). He contends that "the energy within the system can self-organize through unpredictable leaps into different system states" (Morgan, 1997, p. 265). This seems to be occurring within the DRD Department.



As can be seen in the graph to the right, while overall performance was declining (some 17% in three years), the DRD performance, as reflected by mobile ops collections, actually improved! The overall decline in net units is attributed to decreased fixed site collections (a function of Telerecruitment) and, more alarmingly, increased losses in the collection and manufacturing processes. In the reviewed two-year period the mobile operations unit collections increased by some 4% (above graph). Individual DRD Representative performance, as well, was positive. As see in the graph to the left, the number of units attributed to



each DRD Representative was near-constant over a three-year review period, exhibiting a slight positive trend. This was during a time of unquestioned chaos within the department. Chaos, "the ability of simple models [such as the DRD structure], without inbuilt random features, to generate highly irregular behavior" (Sardar & Abrams, 1999) was evidenced in the four-year unpredictability within the system (*e.g.*, seven directors, three managers, and five supervisors in five years, with constantly changing direction, policy, territory/sales areas, and expectations). Self-organizing, the DRD Representatives produced, as we reported, "A stable performance in an unstable system."

Next step: intervention. We will design an intervention that produces stabilizing structure without destroying the flexible innovation of the department. Morgan suggests that, in the "edge of chaos" situations, "small but critical changes at critical times can trigger major transforming effects" (1997, p. 271). The mathematical iterative effect (Warren et al., 1998) discussed in this paper is the mechanism whereby "tiny perturbations can be manipulated" (Dolan et al., 2003) bringing about large changes. We understand that chaotic systems have extreme sensitivity to them (Ditto & Munakata, 1995). We also understand that this "sensitivity to initial conditions" (Gleick, 1987) has, equally, a negative potential. It is for this reason that, while venturing into the new territory of application of "new sciences" to organizational transformation, that we will proceed cautiously.

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Footnotes

1. Gottfried Leibniz is credited by Newton in *Principia* for developing a method similar to his calculus. In actuality, Leibniz published his work inventing calculus before Newton. However, Newton had made the discovery some years before but, as of Leibniz' publication, had not formalized his work. Newton is accepted today as the inventor of the calculus while Leibniz is credited with its first publication (for expanded discussion see Kelley, 2002, pp. 9-10).

2. The classic double slit experiment is simple enough to mentally arrange, to imagine. The results of the experiment, however, defy common logic (and, similarly, what school children are taught in entry-level physics). The result is an exhibited "wave/particle duality." To ensure understanding of the phenomenon we will need to review tenets of classic physics relative to such an experiment. Classic physics dictates that, given the experimental arrangement of an electron gun firing at a screen containing two vertically-arranged slits (one above the other) which rests immediately before a detector screen, will yield a familiar bell-shaped distribution pattern. The electron gun, randomly firing, will propel electrons with trajectories that will have various angles of entry into and through the slits. It will, as well, provide trajectories that will propel electrons into the first screen, stopping the electron from continuing its journey beyond the first to be detected, as the others, on the second screen. Electrons passing through each of the slits will be collected on the second "detector" screen, leaving a mark (depositing their energy). Over time, these accumulated electrons will exhibit a typical statistical bell-shaped curve immediately past the points of entry. Similarly imagined, our source of energy can be a wave that moves toward our first screen with the two slits. As basic physics suggests, the wave will develop corresponding wave action just past the slits (the openings through which the wave flows). These resultant waves on the backside of the first screen will continue to traverse toward

the second detector screen widening, dispersing as they go. It is during their travel to the second screen that, as witnessed countless times on sea-side vacations, the waves will meet, interact, and disrupt the initial wave formation. They create an "interference" patter. The peaks of some of the waves will meet and combine creating a stronger, higher wave. Some, conversely, will be timed such that the troth of one will interact with that of another essentially eliminating the wave. There are, of course, a myriad of combinations between these two extremes. The energy waves will create an interference pattern. However, it is not what experiments of quantum elements reveal. Now imagine the electron gun, firing single electrons, timed as to allow each individual electron ample time to traverse the space between the electron gun and the double slit screen and, then, on to the detector screen where it departs its energy, its arrival recorded. Only upon detection of the arriving electron will the gun fire again, sending another single electron through the same exercise. What might one see at the end of the experiment? What might the detector pattern reveal? Counter intuitively we would find at the end of the experiment that the independent electrons have imparted their energy on the detector screen in such a manner as to create an interference pattern. The electron *particles* created a *wave* pattern. Therefore, each electron must have acted in such as way as to produce it. But, how? We know that we fired the electron gun in such a manner as to disallow any opportunity for an electron to interfere with another. It was, simply, a single particle fired at a screen, one containing double slits through which the electron would pass. Its only "choice," one would well imagine, was through which slit it would travel. But it does not. The debate continues. How does the electron act in this way? Does it somehow know beforehand where it should register its energy so to create an interference pattern? Did the detected electron somehow "communicate" with the next in line? Did it somehow miraculously interference with itself? Did the electron, similarly defying all known properties of physics, split immediately before the slits continuing on as fractions of its former self continuing its trek to the detector where it develops an interference pattern with characteristics of energy required of an intact, whole electron? Physicists simply do not know. What is clear, however, is that atomic level behavior is not that postulated by classic physics. These elements simply behave differently. This is of significant importance in neuroscience where, as Feynman suggests, the basic brain processes depended on quantum elements (*e.g.*, electrons, ions). This dependence is worthy of continued exploration (McElroy, 2004, pp. 10-13).

3. Macro analysis or macrosociology focuses on general features of society such as organizations (see definition Layder, 1994, p. 1).

4. Micro analysis or microsociology focuses on personal, immediate and face-to-face aspects of social interactions (see definition Layder, 1994, p. 1).

5. Later organizational scholars reference these system characteristics as critical in the understanding of organization behavior. They adopt new terminology: adaptation, equilibrium, feedback, and alternative configurations (see section “Organizations as Systems” this manuscript).

6. While many contribute the birth of organizational systems with the “systems” movement, most notably Bertalanffy and General Systems Theory, others trace its genesis further back. Some argue that such study was seeded in the period 1879-1932 with the growth of a systems perspective within the discipline of mechanical engineering and its eventual transition to the social realm of organizations. This view was, naturally given its origin, mechanistic. The concepts taking root and growing then culminated in the work of Frederick Taylor, most notably in his work *Scientific Management*. This concept is captured in an article in *American Machinist*

dated March 3, 1904. In it the author explains that “There is not a man, machine, operation or system in the shop that stands entirely alone. Each one, to the valued rightly, must be viewed as part of a whole” (Shenhav, 1995, p. 6)

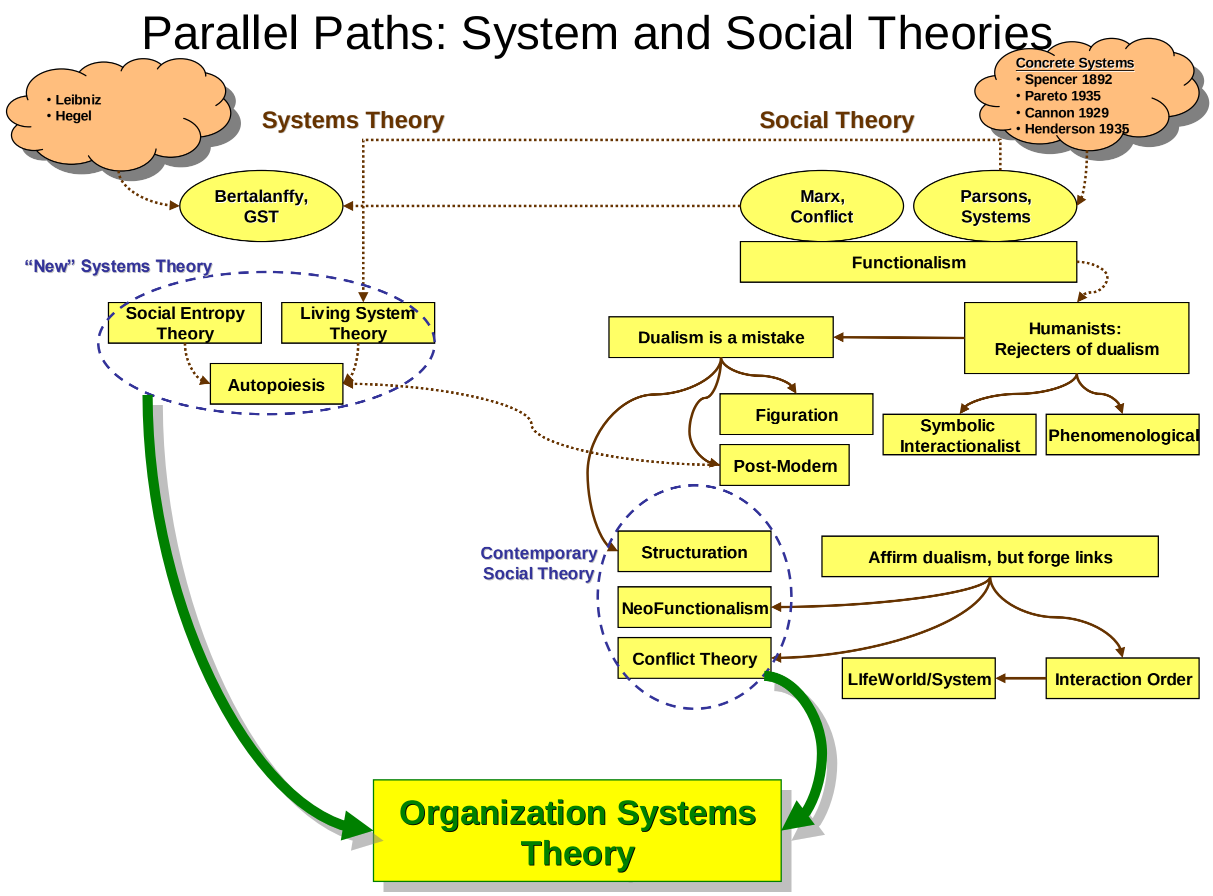
7. The “congruence model of organizational behavior” is attributed to the collective thinking of David A. Nadler and Michael L. Tushman at Columbia University; Jay Galbraith at MIT; and Harold Leavitt at Standford.

8. The “Butterfly Effect” is the notion that a butterfly stirring the air today in Peking can transform storm systems next month in New York (Gleick, 1987, pp. 9-32).

Figure Captions

1. Parallel paths of systems and social theories.

Figure 1


Parallel Paths: System and Social Theories
• Leibniz
• Hegel
Systems Theory
Social Theory
Concrete Systems
• Spencer 1892
• Pareto 1935
• Cannon 1929
• Henderson 1935
Bertalanffy, GST
Marx, Conflict
Parsons, Systems
Functionalism
"New" Systems Theory
Social Entropy Theory
Living System Theory
Autopoiesis
Dualism is a mistake
Humanists: Rejecters of dualism
Figuration
Post-Modern
Symbolic Interactionalist
Phenomenological
Contemporary Social Theory
Structuration
NeoFunctionalism
Conflict Theory
Affirm dualism, but forge links
LIfeWorld/System
Interaction Order
Organization Systems Theory