Toward a Complexity Context for Social Entrepreneurship: A Complex Systems Leadership Perspective on Social Enterprise

James K. Hazy
Adelphi University
School of Business
Garden City, New York 11530

hazy@adelphi.edu

April 10, 2008
Abstract

The growing field of complexity leadership argues that leadership emerges from within interactions. The specific nature of the interaction dynamics that enable organizing to emerge in social entrepreneurial enterprises provides a context for leadership in these projects. Three dimensions of this complexity context are identified and described. A generative context for leadership is present when new knowledge or other resources in the environment are plentiful; in this case, encouraging new ideas and innovations becomes a focus of leadership attention. A unifying context exists when organizational decomposition, time, space and bureaucracy complicate organizing efforts as they scale up; information, knowledge and other resource flows become a focus of leadership in this context. Finally, a convergent context exists as solutions to pressing problems are sought; choosing direction and promoting efficiency become important when resources are constrained. Propositions are developed about the nature and implications of these dimensions at three levels of analysis.

Keywords: social entrepreneurship, complexity leadership, multi-level leadership, systems theory, context for leadership
Toward a Complexity Context for Social Entrepreneurship: A Complex Systems Leadership Perspective on Social Enterprise

INTRODUCTION

An emerging area of research in leadership studies that is relevant to social entrepreneurship is complexity leadership theory (Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; Uhl-Bien, Marion, & McKelvey, 2007). Complexity leadership answers the call for an integrative approach to leadership research that includes context (Antonakis, Cianciolo, & Sternberg, 2004) and fundamentally alters the way we think about and study leadership. It assumes that leadership occurs within a complex system of human agents interacting with one another and that leadership emerges from these interactions. Leadership is not imposed upon the interactions from the outside.

Central to this work is the idea that leadership is embedded in a complexity context (Kauffman, 1993; Prigogine, 1997; Marion, 1999; Thietart & Forgues, 1995). By this is meant that the state of the organization as a system provides a context within which leadership communications and behaviors have relevance to the organization’s members. Leadership involves an ordering of human interactions as they play out over time within the nested environments in which they occur. In their book Complex Systems Leadership Theory, Hazy, Goldstein and Lichtenstein (2007) wrote that leadership in complex systems “takes place during interactions among agents when those interactions lead to changes in the way agents expect to relate to one another in the future” (p.7). In other words, “leadership can be defined as the nature of the influencing process” (Antonakis, Cianciolo et al., 2004, p.5). As such, leadership and time are intertwined.
Interactions that bind individuals together over time and space change the environment for future interactions. The leadership events within the interactions are influenced by the local groups in which they occur, their larger organizations, the institutional and cultural pressures at work around them, and their broader physical, social and economic environments as these change and are changed over time.

Complexity science provides a theoretical framework—called far-from-equilibrium (FFE)—to describe the conditions in which these events occur. As I describe later in the Discussion and Conclusion section, the theoretical framework presented here passes the tests of useful theory that were suggested by Antonakis, Schriesheim et al. (2004).

**Complexity, Far From Equilibrium (FFE) & Dynamical Systems Defined**

The term complexity is used in many ways, but in this paper it has a specific meaning. In this section, the specific usage of the term in complexity science is clarified. Within complex systems, the particular conditions that create the potential for order creation, far-from-equilibrium (FFE) conditions, are then described. Finally, the deductive toolkit—dynamical systems theory—that is at the core of complexity research is introduced in non-mathematical terms.

As is described below, the field of dynamical systems theory involves searching for solutions within complex nonlinear environments in the abstract. A central tenet of complexity research in leadership and organization theory is that solving problems in an abstract dynamical system is analogous to (and hopefully useful for) searching for solutions and solving real problems within complex organizations.
The term “complexity” in organization science has many definitions. In common usage, it is often meant in a sense that is roughly equivalent to “complicated.” The phrases “the design of a microcomputer is complicated” and “the design of a microcomputer is complex” are roughly interchangeable in this common usage. In this article these terms are not the same; the technical definition of complexity is meant throughout. Here complexity “refers to a high degree of systemic interdependence, which among other things, leads to nonlinearity, emergent order creation, and other surprising dynamics” (Hazy, Goldstein, & Lichtenstein, 2007, p.4). One difference is that complicated systems such as microcomputers are often specially tuned to avoid high degrees of systemic interdependencies and nonlinearities. In complex systems, such dynamics are unavoidable and actually define their unique character.

**Far-from-equilibrium (FFE) conditions**

One notion that is central to the nonlinearity and emergent order creation inherent in complex systems is the idea of “far from equilibrium” (FFE) conditions. This idea has been the basis for several recent studies that relate either directly to leadership or are closely related to it (Meyer, Gaba, & Colwell, 2005; Plowman et al., 2007). When imported literally from the physical sciences, FFE conditions imply that there are energy or resource differences in the environment and that these can be exploited locally for organized activity even though, over all, the system and the environment tend toward disorder (Atkins, 1984).

Significant advances in the study of complex systems and order creating interactions have consistently confirmed the principle that at all organized activity in the environment—presumably including human organization and therefore leadership—
occurs in the context of FFE conditions (Nicolis, 1989). The researchers Meyer, Gaba and Colwell (2005) describe an increasing prevalence of far from equilibrium (FFE) conditions in organizational fields as including “volatile ecosystems, emerging sectors, shifting boundaries and proliferating network forms” (p.458). In this article, we clarify what this context means for human organizations and for leadership research.

**Dynamical Systems**

One of the key insights from complexity theory is that organizations can be considered as complex systems of human interactions. These systems are highly interactive and nonlinear in their affects, and as such, in many ways they defy simplified analytical models that can clearly predict outcomes. However, rather than indicating a hopelessness, complexity science offers new analytical tools and methods to address the complexity that has always been there but was not always explicitly recognized.

The good news is that there is robust mathematics of dynamical systems that describe such systems at least in a simplified, illustrative sense. According to a well respected text by Hirsch, Smale and Devaney (2004), “A dynamical system is a way of describing the passage of time of all points of a given space” (p.140). The “space” being considered can be the space of all possible states of an organization, a group or even an institutional field. For example, the dynamical system might describe a business, its markets, its financial situation, its knowledge management system, its climate and its culture. If such a system could be defined—and doing so is, of course, not always easy—the dynamical system would describe how the states of these variables change over time. Once defined, mathematical results can be used to infer important characteristics of the dynamical system and thus, presumably, the organization being studied. This approach
has been used to study the spread of disease, the diffusion of ideas, the nature of markets
and the escalation of commitment in war games, for example (Epstein, 1997). As is
described in the next section, these ideas can also inform leadership research.

THE COMPLEXITY CONTEXT FOR LEADERSHIP IN SOCIAL
ENTERPRISES

By considering leadership of social enterprises within a broader theoretical
context of dynamical systems under far-from-equilibrium conditions, a holistic and
internally consistent contextualization of leadership in these organizations is possible.

Adaptive Tension and Its Relation to the Complexity Context

Organizations, including ones engaged in social entrepreneurship, exist within
markets, institutional fields, and cultural norms which impact not only the organization,
but also leadership within the organization. When the organization is considered to be an
open system within the environment, the specific meaning of FFE conditions for
organizations can be defined. In particular, the existence of a system boundary implies
that changes that cause differences in the environment will put pressure on the system
and result in stress across the open system, a situation that has been called adaptive
tension (Uhl-Bien et al., 2007).

In certain cases, adaptive tension results from a decrease in physical and
knowledge resources available to the organization. As an example, economic hardship or
recruiting difficulty might limit options available to leaders and the organization.
Increasing supply costs—the high price of oil increases the pressure on the airline
industry to adapt, for example—is a case where this is evident. This situation would
stress the leaders in the organization to respond, most likely by encouraging increased efficiency, specialization or contraction. As such, this is called restrictive tension.

On the other hand, adaptive tension can also come from increased access to resources—whether due to growing demand, ready access to financial capital, favorable human and social capital markets or new technology. The glut of telecommunications investment dollars combined with open and ubiquitous access to new networking technologies is an example of adaptive tension that fueled the internet bubble. The ready supply of highly skilled, low wage labor in China and India, combined with an exploding information technology infrastructure creates adaptive tension as US and European companies outsource manufacturing and service functions to these countries. A resource rich environment like those described creates what is called opportunity tension.

Due to geographic and social heterogeneity, local conditions and local access to various types of resources are not uniform for all parts of the organization. Thus, adaptive tension is also not uniform and can be manifested locally as restrictive tension or as opportunity tension depending upon the resource in question and the location. For example, tensions may vary across different product families or divisions in a business or among various agencies in a non-governmental organization (NGO). As an example, a shortage of accountants in New York City might place restrictive tension on the finance department there even as other locations are flush with highly skilled accountants. At the same time, sales might be booming for the company overall creating opportunity tension for the organizations in its markets.

The above example illustrates an additional element of adaptive tension. Large organizations as they currently exist were necessarily “constructed” in the past by
combining lower level divisions, functions and subgroups into a functioning whole (Simon, 1962). Later we discuss how this affect impacts leadership, but for now it is enough to point out that this internal decomposition also impacts the specific way tensions in the environment are propagated through the organization. In other words, because organizations are decomposed into components, external adaptive tension pressure is not translated and propagated throughout the system uniformly. Rather it is impacted by the seams in the organization. In this process, relevant information about the environment may be overwhelmed by this internally generated noise. This affect—called *decompositional tension*—would be observed as inter-group conflict and confusion. In a sense it is a self-inflicted complicating aspect of adaptive tension although it also unavoidable (Simon, 1962).

As the above examples show, the level of adaptive tension varies within the environment, according to the resource in question, and over time. In addition, the level of adaptive tension at work at each location within an organization determines the context in which leadership must occur. Because these dynamics occur across all levels of analysis, so too the *complexity context for leadership* is manifested at all levels of analysis. The above implies a proposition:

**Proposition 1:** The level of adaptive tension between the system and its environment varies, both globally and as observed locally within the system and along its boundary. Its particular value at each location relates to the particular complexity context for leadership at work within the organization in each locality. Further, this context has different aspects at the micro, meso and macro levels of analysis.
Below we describe in more detail all three types of adaptive tension and discuss how they define the complexity context for leadership.

**Opportunity Tension as a Generative Context for Leadership**

Changes in the environment are most commonly reflected in changes to resource flows and institutional fields around and within the organizations. When markets, technology, demographics or political or economic conditions change outside of the organizational “open systems,” these pressures are propagated through the systems as changes to the relevant resource flows within them. The term “resource” is meant very generally and includes capital, materials, labor, human capital, social capital, organizational routines, capabilities, technology and knowledge as well as financial resources. As an organization is stressed by adaptive tension, this stress does not remain on the boundaries but is propagated into the system and is reflected in an ordering of resource flows that is apparent throughout the system.

Opportunity tension implies that there are more than adequate resources of certain types available for the organization and its members. There are resources available to invest in new technologies or to provide additional benefits or perquisites to members of the organization, for example. This relative prosperity creates problems of its own and potentially new tensions.

Opportunity tension is closely related to the notion of slack resources described by Cyert and March (1963). Researchers who have studied innovation in the context of slack resources have found that slack at first helps and then hurts innovation. In other words, there is a curvilinear relationship between slack resources and successful innovation (Nohria & Gulati, 1996; Singh, 1986). A fecund ecology enables the
organization or group to engage in locally initiated projects, or “skunk works,” to expand its boundaries, and to gather and to store resources locally in a decentralized free-for-all that remains relatively disorganized and possibly even unpredictable. Initially, excess resources are helpful to innovation. Beyond a certain point, however, absent the effective leadership that is described here and in later sections, excess resources can actually lead to a decline in innovation. This implies a proposition:

**Proposition 2:** When an organization or group experiences opportunity tension, leadership activities that a) enable the emergence of new ideas to take advantage of new opportunities and then b) provide orderly feedback and integration of this novelty within a larger community, are more valued that others by the organization and its members.

Because these activities tend to generate novel ideas and new options for the organization and its members, leadership that occurs under opportunity tension is said to occur in a generative leadership context. As is described in more detail in a later section, leadership in this context catalyzes creativity, innovation and growth.

**Decompositional Tension as a Unifying Leadership Context**

As stress from adaptive tension in the environment propagates through the boundary and into the system, decompositional tension can be observed as changes to the patterns of stress that are due to residual structural artifacts such as budgets, policies, hierarchy and culture, in short, from residual bureaucracy (Marion & Uhl-Bien, 2007). As stress comes up against these internal barriers, the flows within the dynamical system are altered. These discontinuities may cause members of different groups to compete with one another for resources; when adaptive tension is translated in conflicts among
local groups, decompositional tension results, and this creates its own complexity context for leadership.

Decompositional tension implies that within the same organization it is likely that some parts will have more than adequate resources of certain types and others will have less. This creates an internal management focus aimed at gathering and preserving access to the organization’s resources for appropriate functions and processes. An example of this would be when more than adequate capital dollars are allocated to projects that are considered “strategic”—opening new offices or launching new products—while infrastructure projects like building and system maintenance are starved for resources.

These observations imply a proposition:

**Proposition 3:** Decompositional tension implies that leadership must also take on an internal focus that includes resolving conflicts, establishing, breaking down and reestablishing internal and external boundaries while deconstructing and reconstructing an organizational identity.

Because these activities tend to unify the growth of novelty and integrate it with prior structure, leadership that navigates, mitigates and extrapolates decompositional tension is said to occur in a **unifying leadership context.** As is described in a later section, leadership in this context establishes appropriate information and resource flows, catalyzes esprit de corps and clarifies the in-group from the out-group at all levels.

**Restrictive Tension as Convergent Leadership Context**

A commonly occurring form of adaptive tension involves changing constraints that put stress on the system when the resources available from the environment are reduced. In complexity terms this means the inflow of resources declines and the system
must conserve its resources to survive. Restrictive tensions effectively draw the system back from a more complex, less predictable generative context of uncontrolled growth to a less complex more predictable state.

A biological example of this was described by Nicolis (1989). He describes a class of single-celled organisms that respond very differently to a resource rich versus a resource starved environment. When the ecology is resource rich, each behaves independently foraging for itself. However, when resources are constrained, the organisms actually form into a collective and perform specialized tasks, acting almost like a single organism. In other words, when necessary, these otherwise autonomous organisms cooperate to survive.

There are many examples of this in human systems as well. The tendency of human groups under restrictive tension is to pull together but also to focus on fewer, more limited objectives. Examples of this tendency can be observed in times of famine where food resources are limited, during natural disasters such as Hurricane Katrina in the Southern United States during 2005, or through loss of life during combat, disease of other situations which lead to a “rethinking of what’s important”. When organizations become short on cash, for example, there is a tendency to tighten controls, to clarify spending policies, and to limit spending to fewer initiatives.

In sum, restrictive tension implies that less of certain types of resources are available for use in parts of the organization. This forces the organization to become more efficient and focused. In other words, the organization must become more finely “structured” around a more predictable state. This implies a proposition:
Proposition 4: When the organization and the environment change so as to increase restrictive tension on the organization or group, leadership behaviors that relate to structuring activities and that imply greater predictability in operations and outcomes will be more highly valued than other forms of leadership by the organization and its members.

Because these activities tend to converge toward predictable, relatively simple operating models, leadership that occurs under restrictive tension is said to occur in a convergent leadership context. As is described in a later section, leadership in this context catalyzes efficiency, order and predictability.

A TYPOLOGY OF COMPLEXITY CONTEXTS FOR LEADERSHIP

In this section each of the three contexts identified above is described in more detail. In particular, I describe the unique aspects of each at different levels of analysis. At the micro level, the leadership influence on individual interactions is described. How, for example, are the focus and actions of leadership observed and experienced by others in this context? These micro leadership events must come together through leadership at the meso level which operates to organize on a larger scale. Finally, the organization level implications of effective leadership are related to specific organizational outcomes in each of the three contexts: generative, unifying and convergent.

The Generative Leadership Context: A Closer Look at Novelty

The above analysis focuses on how varying degrees of adaptive tension create three different complexity contexts for leadership. First, inferences about the organization and its leadership that can be made by considering interactions among leaders and follows at the individual—or micro—level are considered in the context of
adaptive tension. We then consider what happens when these pockets of innovation interact with one another in a meso structuring process and explore these larger affects of adaptive tension as they are experienced throughout the organization. How these dynamics are related to relevant outcomes such as innovation and growth at the organization level is then taken up in the final section.

**Leadership and the emergence of novelty within organizations**

No individual in organizations is completely isolated from the environment. In fact, it is a characteristic of human systems that each individual interacts with the environment each and every day. Thus an organization’s boundaries remain permeable to information flows both into and out of the system. As a result, interactions that occur inside the system—among members of a product team, for example—involve the processing of information that is potentially brand new to the system. It may also suggest a new direction for the group or for the larger organization. These individual level quasi-random interactions can lead to group level and organizational level novelty through what has been called adaptive leadership (Uhl-Bien et al., 2007). When the situation is nurtured with adequate resources of the right types and in the right ways, the organization is operating within a generative leadership context.

More specifically, each person in the organization can be assumed to act in his or her own self interest in so far as it can be determined. Interactions among individuals can lead to the formation of group consensus and coordinated action (Phelps & Hubler, 2006). The group’s direction can change, however, due to local dynamics at work as individuals propose alternatives. However, individually initiated changes to group direction may or may not align with the overarching organizational direction, and as such
they may remain uncorrelated with the system as a whole. On the other hand, they may
also represent local novelty that may ultimately spread and emerge as a global novelty
that can change the direction of the larger organization. What happens to these local
novelties once they are expressed is the subject of the next section.

**Meso level interactions enable positive and negative feedback**

As novelty emerges in teams, it is important to recall that although the novelty
occurs locally within a team, that team also interacts with the larger organization that
constitutes its local environment. In other words, local novelty occurs within the
organization’s internal resource flows, and these flows reflect the stresses put on the
system by true adaptive tensions coming from the external environment.

The simplest case to consider is when there is no decompositional tension. Where
opportunity tension is present, there is a fecund environment at least in some resource
context. In these cases, there are many customers, many opportunities or perhaps the
organization is flush with cash. Under these conditions, the success of a particular
approach would lead to the consumption of more resources. This in turn leads to more
growth as even more resources are consumed in a positive feedback cycle. This was
what happened at Intel during the microprocessor growth cycle in the 1970s and 1980s
(Burgelman, 1994). On the other hand, because resources are plentiful, even failing
projects would continue to consume resources. In times of plenty, the negative or
regulating feedback that often results from restrictive tension can be significantly
weakened. There is plenty for everybody, and evolutionary selection eliminates so few
experiments that many, many different variations continue to thrive regardless of their
contribution to the organization’s overall fitness.
Decompositional tension complicates these situations but can also serve to balance positive and negative feedback as needed. Internal boundaries, seams and silos in the organization that remain from the organization’s prior history can distort the “natural” ordering of resources that would normally serve to reflect on the inside of the organization, the patterns of exogenous adaptive tension that are experienced on the boundary of the organization. The human choices and the behaviors of those who are charged to maintain stability in the organization tend to relate to prior structures rather than to the emerging ones.

These activities have been called administrative leadership (Uhl-Bien et al., 2007). Visibility to the outside environment can be fully obscured for these individuals. They often act with little of no awareness of the larger adaptive tensions under which the organization is straining. Under these conditions, it is not surprising that positive and negative feedback can be applied to emergent novelty in ways that appear to be random when compared to the ordered direction that would be implied by the restrictive and opportunity tensions at work in the system. Often, therefore, actions in the organization do not accurately reflect the situation in the environment. As is described in later sections, these challenges go far beyond what has been previously described as administrative leadership (Uhl-Bien et al., 2007).

**Effective leadership in the generative context at the organization level**

The above descriptions raise the question about when and how leadership relates to the emergence of these novelties and the feedback they receive in the context of the organization’s resource flows. When leadership is effective, the combination of novelty and selected positive feedback can result in innovation and growth at the organization
level. Innovation that is grown in this way may involve changes to routines or organizational capabilities, or it may involve new product or technology ideas. As such, these dynamics represent a generative context for leadership in which future possibilities for the organization are generated. These ideas lead to a proposition:

**Proposition 5:** Leadership in a generative context has three aspects:

(a) Effective Leadership communication and behaviors at the micro level relate to encouraging the conditions for individual and small group communication and creativity and thus enabling the emergence of organizational novelty.

(b) Effective leadership communication and behaviors at the meso level relate to the creation, maintenance, elimination or extrapolation of organizational structures that ensure the orderly flow of resources and knowledge and that organize feedback with respect to nurturing positive novelties in the system and dampening unsuccessful ones.

(c) At the macro level, higher levels of effective leadership in a generative context relate to increased innovation and growth in new and adjacent markets.

The Unifying Leadership Context: Coupling of the Whole

One observation from complexity science is that the seeds of novelty and change occur locally and emerge from local interactions. As described in the previous section, this is because heterogeneity of information and individual attributes can lead to unpredictable results. This novelty can be quickly dampened and eliminated, or it can be reinforced depending upon the local intra-organizational environment in which it occurs.

But how do agents in the local environment know how to react to this novelty? Is a
particular innovation good and thus worthy of being reinforced? Or is it dangerous and therefore must be quickly eliminated?

These questions point out the importance of transporting information from place to place in the organization. To do this, an information signaling network is needed to enable coupling among pockets of novelty and thus a level of coherence among locally emergent phenomena. If there is communication between a group and its neighbors, the novelty may be imitated in its local neighborhood and then replicated broadly in a manner similar to how crystals replicate one another as water turns to ice. The diffusion of innovation in this way is a type of positive feedback. As more units adopt the change and learn to operate in a more efficient manner, an ever increasing number of others become exposed to it and thus learn the practice. As a result of an information transport process like this, the number of those who have adopted the practice increases exponentially. In the next section, this information transport process is described in more detail.

**Complex organizing at the micro level through a signaling network**

In many ways the need for individuals in organizations to communicate with one another is obvious. However, research into the complex nature of these communications pathways and how they unfold has been limited. It is often assumed that in large organization, communication is primarily top-down with the downward articulation of strategy being the major flow of organizing information. Research in upper echelons and top management teams (Hambrick & Brandon, 1988; Waldman & Yammarino, 1999) as well as a good deal of transformational leadership (Bass & Avolio, 1994; Bennis & Nanus, 1985; Kouzes & Posner, 1987) and charismatic leadership (Conger & Kanungo,
1987; House, 1977) research implicitly makes this assumption: The leader articulates a vision and people organize around that vision.

The complexity paradigm offers a different perspective, however, with bottom-up and side-to-side communications given parity with the top-down channel (Lichtenstein et al., 2006; Panzar, Hazy, McKelvey, & Schwandt, 2007). Holland (1975; 2001) described signaling networks in complex adaptive systems of agents as a critical element of coherence and system-level coordination. In a simplified model, Siggelkow and Rivkin (2005) have explored how upward information flows impact decision making within the complexity paradigm. The complexity of such networks is particularly germane when organizing is decentralized (Solow & Szmerekovsky, 2006). The critical question for a complex adaptive system of interacting autonomous agents is this: How do disparate organizing projects remain part of a whole?

The simple answer is that complex systems and thus organizations require a bottom-up and side-to-side as well as a top-down communication signaling network to maintain correlated behaviors (Holland, 1975; 2001). To decide on an appropriate organizing strategy, the organization’s members often search for successful communication and influence patterns among many possible approaches to leadership (Panzar et al., 2007). Individuals and their collectives vacillate at different times and at different places between centralized and decentralized decision and control structures (Solow & Szmerekovsky, 2006). When new ideas are identified, their existence must be made known, and if they are useful elsewhere, these ideas need to be imitated and adopted. This allows distant pockets of activity to be coupled, loosely or otherwise into a coherent organization-wide pattern wherein beneficial local novelty spreads across the
organization. In other words, an information signaling network enables coherence and correlation among disparate, locally emergent individual and group activities all within the boundaries of a system. As is described next, these boundaries are related to the distance across which correlation can be observed.

**Meso-structures promote correlation across space and time**

Bottom-up, emergent novelty implies a level of coherence among participating agents, but there is no guarantee that these activities are related in any way to a broader organization. Pockets of novelty are not the system. They can become part of a larger system when they become correlated with one another along one or more dimensions that define the system. The distance across which activities remain correlated with one another is called the *correlation length* along that dimension.

Examples of dimensions with relevant correlation lengths might include familiar concepts like geographic dispersion where correlation length represents the maximum physical distances across which the activities in branch offices can be observed to correlate with one another. The daily specials and employee greetings at all of the Starbucks locations in Chicago might be correlated, for example, while this might not be the case for the Starbucks locations in Shanghai. A non-geographic dimension might be the target markets within a consumer products company in which product lines extend across several markets. It is likely that these disparate lines all have correlated distribution and product development activities, for example. Other dimensions might include the technology that is used, human resources deployed or even financial performance metrics, the latter characterizing large conglomerates such as the General
Electric Company (Slater, 2001). System boundaries will change to approximate the extent of coherence along various dimensions.

**Effective leadership in the unifying context at the organization level**

Adaptive tension in the environment and especially decompositional tension within the organization can make the unifying context difficult to navigate. As a signaling network is implemented and boundaries are navigated, one would expect that effective leadership in a unifying context would enable correlations of substantial length to be maintained. For example, the organization would be observed to have a more coherent strategy, a heightened sense of mission and a strong organizational identity. Taken together, these ideas imply a proposition:

*Proposition 6: Leadership in a unifying context has three aspects:*

(a) *Effective leadership communication and behaviors at the micro level relate to establishing a signaling network to couple disparate loosely coupled organizational units with one another and with central groups.*

(b) *Effective leadership communication and behaviors at the meso level relates to a) creating, maintaining, eliminating or extrapolating internal and external organizational boundaries and b) defining common grammars, lexicons, and interaction protocols among individuals and groups.*

(c) *At the macro level, higher levels of effective leadership in a unifying context relate to organizations with a globally observed attribute such as a more coherent strategy, a heightened sense of mission and a stronger organizational identity.*

**Convergent Leadership Context: A Search for Stability**
As is described above, organizations, or more precisely their states, can be described as dynamical systems. In this section, the implications of this assertion are explored.

**Dynamical systems and human organizations**

As described earlier, there is robust mathematics that describes dynamical systems. Recall that a “dynamical system is a way of describing the passage of time of all points of a given space” (Hirsch et al., 2004, p.140). The space being considered can be the space of all possible states of an organization, its people, its markets, its financial situation and its culture, for example. If such a system can be defined, the dynamical system would describe how the states of these variables change over time, and important characteristics of the dynamical system—and thus presumably the organization it represents—can be inferred.

To illustrate how this analysis process works, it is instructive to realize that dynamical systems often have simple solutions or *equilibrium points*. This means that certain relationships among values for variables—market demand, number of employees, wages levels, profit targets, supplier costs, etc.—remain relatively stable over time. When such a solution is identified and when the system reaches that point, it becomes stable. There is no change at all to the system’s state as time or other relevant variables change. Although it may be impractical to find an exact point of stability in the real world of changing organizations, one of the key results from dynamical system mathematics is that as long as the system is “sufficiently near” one of these equilibrium points, the behavior of the system can be approximated by a set of linear equations. This is why “linear thinking” sometimes works in organizations: it can be a reasonable
approximation of reality when the organization is relatively stable. Similar techniques can be used to simplify the analysis of more complex solutions.

**Basins of attraction**

In some cases, an organization would tend toward the equilibrium point over time in which case it is called *asymptotically stable*. All of the points that are asymptotically stable with respect to a solution are said to form a *basin of attraction* for that solution. This means that if an organization’s state is within a basin of attraction, it would tend over time to move toward the stable solution in question. A physical example of this is a dampened pendulum. No matter where the pendulum starts, over time friction will eventually overcome the oscillation and the pendulum will stop at its downward most position. A human example might involve US ten dollar bills scattered in a room where people randomly enter and leave and do so with impunity. No matter how many bills there are and where they reside in the room, eventually there will be none left on the floor.

Not all systems have single point solutions. In fact organizations are notoriously complex and may not have easy solutions at all. When a system has multiple stable solutions, it may also have multiple basins of attraction. In this case, the initial state of the organization (where the ten US ten dollar bills are thrown) determines which if any basin of attraction it is in and thus to which stable state it will tend over time. An organization without basins of attraction is not stable and will never settle down.

**Bifurcations and multi-stability**

The structure of these areas of relative stability of organizations is described by the equations that represent the dynamical system over time. However, the structure also
depends upon the values of certain system parameters. Parameters might include such constraints as timeframes, human resource policies, budgets, market demand, supply costs, inventory levels, etc. As parameters change, the nature of the system’s relevant basins of attraction might also change. For example, a system with a single stable state and thus a single basin of attraction under a certain parameter setting might bifurcate into one with two or more possible stable states when the parameter changes. The reverse is also true. A system with many possible basins of attraction might simplify into one with a single basin of attraction as a parameter changes.

An example of this is seen in a reinterpretation of the team dynamics described by Gersick (1989). She found that when the time available for a project was perceived to be more than was needed to complete the project, many possible approaches were considered, and it was difficult for the team to converge to a solution. Using dynamical systems terms, the group was in a multi-stable state. But when a certain parameter was reduced—in this case the time available to complete the project—the group quickly converged on a single solution. In other words, when the parameter of time remaining fell below a critical value—called the bifurcation point—the system’s structure changed such that it had a single basin of attraction and convergence occurred.

The key point is that changing the value of certain parameters can change the specific convergent context under which leadership might occur. Other examples of parametric changes that might impact the organization’s convergence dynamics include: budgetary events, availability of skilled human resources, organizational climate, marketplace changes, the availability and timing of supplies, inventory levels and new technologies.
Choosing among basins of attraction

As adaptive tension changes in and across the environment, the bifurcation parameters that describe the system are also likely to change. As these change, the topography of the landscape that characterizes the basins of attraction available to the system likewise changes. The organization can potentially converge asymptotically to one, but only one, of multiple stable states that might be available to it. Thus it becomes important to understand the initial position where the organization sits within the various possibilities. It is also important to understand how changing the value of the bifurcation parameter (as in the example when there is less time available to complete the project) also changes the very structure of the space of organizational possibilities. Navigating these dynamics—and convergence within them—is thus an important context for leadership.

A simple example is shown in Figure 1. Here a system has entered a state of bistability and could adopt one of two states either of which would be relatively stable in the environment. For example, the work group might organize around a current project plan or choose an alternative approach. It is important to note that the state that the organization adopts at time $t + 1$ is related to its current state at time $t$, shown as the dotted line in the figure. It is also dependent upon the probability that a “perturbation” or novelty—for example when a person proposes a new idea, and the group adopts it—might occur at time $t + 1$ that shifts its position to the point shown by the particle in the figure. Absent such novelty, the system would tend naturally to the trough on the left because the system resides in the basin of attraction around that stable or quasi-stable state. If the system reaches point shown by the particle, then it is possible that the
system will enter the basin of attraction on the right and thus would tend to a different stable state over time. In this sense, a system may trend toward multiple asymptotically stable states. Which state it ultimately adopts depends upon where it begins, the nature of the novelty it produces, and the specifics regarding how the system converges over time. These parameters define the *convergent context for leadership*.

Convergence within basins of attraction

The discussion above considers a human system of interactions as a dynamical system that can be described as a set of state variables approaching one or more asymptotically stable states. Proposition 5 implies that novelty and thus system perturbations occur with the human interactions. Proposition 6 implies that these occur within a broader systemic ordering that enables positive and negative feedback to act on these fluctuations. We are now in a position to describe this ordering more specifically.

When novelty arises in the system, that novelty exists in the context of the system’s asymptotic stability. In other words, novelty that moves the system closer to its asymptotic state would tend to be reinforced; novelty of this type lowers the system within its attractor basin—perhaps by increased cooperation among individuals and thus promoting more highly correlated action within work groups—and is reinforced when that coherence moves the system toward its attractor. On the other hand, the same systemic forces (instantiated as individuals who are engaged in leadership interactions) would tend to dampen and perhaps extinguish this novelty if it moved the system away from the attractor. When the system is in an asymptotically bi-stable or multi-stable state, a perturbation or novelty that moves the system away from one attractor can with
enough momentum, resist systemic dampening forces and cross to a different attractor basin.

To summarize, when a system is in an asymptotically stable state—whether it has a single, or it has multiple stable configurations—it exists within a basin of attraction such that perturbations or novelty that cause the system to approach stability are maintained while those that would move away from stability are dampened and extinguished. These systemic affects are enacted as leadership within individual interactions. This holds true as long as the perturbations are below a certain threshold value along the relevant dimensions. Novelty that represents a perturbation above this threshold can cause a bi-stable or multi-stable system to approach a different attractor. Finally, the specific structure of these attractor basins is determined by its bifurcation parameters. To the extent these parameters change over time—like the time left to complete a project, for example—the very topography of the landscape that describes the available basins of attraction also changes. The specific instantiation of these dynamics define the convergent context for leadership in organizations

**Convergence when the organization is not in an attractor basin**

Recall that bi- or multi-stability come into existence when the bifurcation parameter crosses *above a critical threshold value*. Importantly, in many systems, this state of multi-stability can continue to exist as long as the bifurcation parameter stays *below a second critical value*. Beyond this second value, the system is no longer “stable” in the same sense. Although the reader should be aware that there are many definitions of chaos, the system behavior described here is sometimes called *chaotic* because beyond
this second critical value the system exhibits an extreme case of sensitivity to initial conditions along some dimension.

This means that when a system has moved beyond the point of being multi-stable, it is no longer predictable along at least one key dimension. A small fluctuation or novelty can thus have unpredictable results. Under these conditions, a novelty that moves the system in a particular direction may cause the system to diverge in that direction so that the system overall no longer converges.

Under divergent conditions it is important to realize that adaptive tension is impacting the system’s bifurcation parameters and these in turn determine the system’s stability characteristics. Practically, therefore, under these conditions, it is the relationships between adaptive tension and the organization’s bifurcation parameters that become the focus for the firm. If the system can be insulated from some aspects of adaptive tension or more directly if the bifurcation parameter can be adjusted downward, the system may enter a state of multi-stability and convergence can begin. One approach to the former might be to make boundary changes that buffer the system from high levels of adaptive tension in the environment. An example of how firms address adaptive tension is by changing the firm’s boundaries through forward or backward integration. In the latter case, firms reduce volatility in their supply change as a way to reduce adaptive tension along the relevant resource dimension. An example of the direct manipulation of the firm’s bifurcation parameters that occurs often in organizations is a management process that establishes public commitments and firm timeframes for product delivery (Lynn & Reilly, 2002). “Putting a stake in the ground” serves to limit divergent possibilities and thus to drive collective activity toward some level of convergence. The
well established practice of management by objectives (Drucker, 1954) can be thought of in this way.

Effective leadership at the organization level in the convergent context

The above discussion implies that leadership occurring within the convergent context has certain attributes. Managing the adaptive tension felt by the organization and thus adjusting the value of the system’s bifurcation parameters becomes an important context for leadership. As these values change, the leadership challenges that must be addressed also change at all levels of analysis. This leads to a proposition:

Proposition 7: Under FFE conditions, all leadership activities can be considered to occur in the general context of dynamical systems of human interactions some of which have asymptotically stable solutions. Leadership occurs as dynamical systems are brought within a convergent context. This context has three aspects:

1. When a parameter (for example budgets, timeframes, etc.) as measured locally moves below a certain threshold value, individuals and groups experience restrictive tension at the micro level; effective leadership activities relate to communication and behaviors that dampen wasteful and distracting individual actions to enable convergence to relative stability within a basin of attraction.

2. Changes within the organization may cause it to pass a bifurcation point such that the organization enters a multi-stable state where more than one attractor can serve as a stable future state toward which activities can converge. Under this convergent context at the meso level, effective leadership activities relate a) to interactions among individuals at all hierarchical levels that enable collective choice among possible future states, and b) to the communication and behaviors...
that adjust parameters (such as budgets, timeframes, or knowledge resources) that apply restrictive tension and enable convergence within the chosen basin of attraction.

3. At the macro level, higher levels of effective leadership in a convergent context relate to members reporting clear and consistent objectives and measurements and the organization exhibiting relatively stable performance along publicly identified metrics.

Taken together the theory and propositions described in this paper represent an overarching and comprehensive typology of the various complexity contexts in which leadership occurs. This typology is summarized in Table 1. A research agenda would tend to explore the specific leadership styles, behaviors and communication strategies that are effective in each of these contexts, how these vary one context to another, how they interact with one another, and how leaders learn to tailor their approach according to context.

Discussion and Conclusion

As described herein, far from equilibrium (FFE) conditions imply an endlessly changing environment wherein the organization and its leadership must react and adapt. These conditions are common in social entrepreneurship projects. The ever changing dynamics that characterize social entrepreneurship imply that leadership in organizations faces different challenges depending upon the particular context in which it occurs.

In some cases, when the organization or a part of the organization is under restrictive tension, leadership responds in ways that help the system converge to a state
wherein it uses its resources more efficiently. In this context, one would expect more centralized, traditional management structures—what has been called administrative leadership (Uhl-Bien et al., 2007)—to emerge as a dominant mode of organizing. In other cases, the leaders of an organization might find themselves in a relatively fecund ecology where resources are plentiful. In this case, opportunity tension creates its own demands on leadership as potentially divergent novel approaches to organizing emerge. Engendering creativity in this way has been called adaptive leadership (Uhl-Bien et al., 2007). Decentralized decision-making and locally generated resource pools present their own challenges to leaders who engage in what has been called enabling leadership (Uhl-Bien et al., 2007). These leaders must work to foster change and to fight off the disintegration of the whole. Finally, all of these dynamics occur in the context of past history. Decompositional tension arises when resource flows within the organization are distorted by prior organizational structures. Because of this distortion, actors internal to the organization experience adaptive tensions that are only indirectly related to what is actually occurring in the environment. The challenge inherent in navigating these organizational structures has also been called administrative leadership (Uhl-Bien et al., 2007).

The leadership dynamics described in this article are posited to impact the level of fitness achieved by the system in the environment. In particular, novelty and its coupling within and across the system may help the organization and its members act in new ways. However, regardless of the organization’s internal dynamics, there are also evolutionary selection pressures at work in the environment which may cause some organizations to fail while others survive. Survival implies potential for the organization to replicate its
processes in others as Toyota has broadly propagated its system into other manufacturing companies beyond its boundaries. This makes sense as surviving organizations have, presumably, developed leadership capabilities within the generative, unifying and convergent contexts that tend to increase an organization’s survival potential. As these dynamics are imitated by others, organizational forms evolve in the environment. These configuration/reconfiguration mechanisms would be an interesting area for future study.

We are hopeful that this article contributes to the field by providing a framework for studying leadership in the context of a complex systems epistemology as applied to human organizing. Further, the framework compares favorably against the criteria for acceptable theory that were suggested by Filley (1976). First, it is internally consistent. All of its elements are based upon well developed complexity science ideas and dynamical systems mathematics. Second, it is externally consistent, or surely is intended to be. Although considerable field work is needed to fully test the assertions made herein, none of the propositions adduced are expected to be counter to experience. Further, as was described in this article, many assertions are indeed consistent with existing research. Third, the propositions are framed as testable (and falsifiable) hypotheses. Fourth, the theory is general. It is meant to apply to all human organizations, large and small because all organizing projects can be considered as complex systems. Fifth, the theory is parsimonious. By drawing results from the elegant mathematics of complexity science and dynamical systems theory, this article provides a single, straightforward description of a complexity context for leadership that is as simple as the reasonably advanced mathematical framework that it employs would allow, but it is not overly simplified so as to be too general to be useful. Finally, as suggested by Antonakis et al (2004), this
approach was specifically developed to be relevant at all levels of analysis, from the micro level of individual and dyadic interactions to the macro level of organizations and institutions. Although only a beginning, the theory proposed here would seem to be well positioned to support a robust research agenda that adds a complexity context to leadership decisions, communications and behaviors.

Finally, one of the benefits of this approach is that it opens up the possibility that, by using the complexity science tool-kit, it may be possible to describe leadership in social entrepreneurial enterprises in mathematical terms, to model them computationally and to simulate outcomes that can then be tested in the field. If this turns out to be the case, perhaps a deductive approach to research can emerge as a full and useful complement to the inductive approaches that have thus far characterized the field.

References


Table 1.

A typology of leadership contexts in complex organizations at three levels of analysis.

<table>
<thead>
<tr>
<th></th>
<th>Generative</th>
<th>Unifying</th>
<th>Convergent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Micro:</strong></td>
<td>Creative interactions needed to enable the</td>
<td>A signaling network needed to couple disparate</td>
<td>Wasteful or distracting actions must be</td>
</tr>
<tr>
<td>Individual and intra-group interactions</td>
<td>emergence of novel ideas.</td>
<td>units with one another and with central groups.</td>
<td>dampened to enable a stable program of action.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meso:</strong></td>
<td>Inter-group feedback processes (positive &amp;</td>
<td>Changing internal and external organizational</td>
<td>Change may cause bifurcations to bi- or</td>
</tr>
<tr>
<td>Interaction</td>
<td>negative) needed to select and reinforce</td>
<td>boundaries and interaction protocols among</td>
<td>multi-stable states; groups must search</td>
</tr>
<tr>
<td>across groups and divisions</td>
<td>positive novelty.</td>
<td>them.</td>
<td>among these to choose a future and converge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>to it.</td>
</tr>
<tr>
<td><strong>Macro:</strong></td>
<td><em>Opportunity tension</em> creates potential for</td>
<td><em>Decompositional tension</em> can be leveraged and/or</td>
<td><em>Restrictive tension</em> creates pressure for</td>
</tr>
<tr>
<td>Organizations and divisions</td>
<td>innovation &amp; growth.</td>
<td>mitigated to provide coherent strategy and</td>
<td>clear and consistent objectives and stable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>organizational identity.</td>
<td>performance along publicly identified metrics.</td>
</tr>
</tbody>
</table>

Complexity context for social entrepreneurship
Figure 1. Organizations can begin to exhibit bi-stability (shown here) or multi-stability as time passes from $t$ to $t+1$, a condition where multiple stable configurations are possible depending upon the system’s history and dynamics; both troughs represent stable configurations. A system starting at the wall of a trough would naturally tend toward the minimum point unless it is “perturbed” through novelty to point shown by the particle in which case it might converge to either trough depending on whether it backslides to the trough on the left or is transformed by converging to the trough on the right.