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Practitioner

Complexity leadership theory: An interactive perspective on leading in complex adaptive systems

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Traditional, hierarchical views of leadership are less and less useful given the complexities of our modern world. Leadership theory must transition to new perspectives that account for the complex adaptive needs of organizations. In this paper, we propose that leadership (as opposed to leaders) can be seen as a complex dynamic process that emerges in the interactive "spaces between" people and ideas. That is, leadership is a dynamic that transcends the capabilities of individuals alone; it is the product of interaction, tension, and exchange rules governing changes in perceptions and understanding. We label this a dynamic of adaptive leadership, and we show how this dynamic provides important insights about the nature of leadership and its outcomes in organizational fields. We define a leadership event as a perceived segment of action whose meaning is created by the interactions of actors involved in producing it, and we present a set of innovative methods for capturing and analyzing these contextually driven processes. We provide theoretical and practical implications of these ideas for organizational behavior and organization and management theory.

Introduction

As twenty-first-century management continues to emphasize decentralized organizing structures and co-evolutionary ecologies of firms, institutions, and markets, there is a growing recognition that traditional top-down theories of leadership are at best overly simplistic (Osborn *et al.*, 2002). That is, leading-edge theorists and the leaders they inform are questioning the assumption that the essence of leadership rests within the character or the characteristic behaviors of effective supervisors (Seers, 2004). Worse, the notion that a leader exogenously "acts on" organizations in order to achieve the leader's objectives may be misguided in the presence of the insight that organizations are highly complex and nonlinear (Meyer *et al.*, 2005). There is also a growing realization that effective leadership does not necessarily reside within the leader's symbolic, motivational, or charismatic actions.

If leadership is not "in" a leader or "done by" a leader, however, how are we to insightfully conceive exactly what constitutes leadership and from where it originates? A novel approach for answering these questions is grounded in complexity science, namely the notion that *leadership is an emergent event*, an *outcome of* relational interactions among agents. In this view, leadership is more than a skill, an exchange, or a symbol – leadership *emerges through* dynamic interactions (Bradbury and Lichtenstein, 2000). "Complexity leadership theory" investigates the role of leadership in expediting those processes in organizations through which interdependent actions among many individuals combine into a collective venture (Drath, 2001; Meyer *et al.*, 2005).

Founding the approach of this paper on complexity theory *per se* moves us to a whole-systems view and thus away from the more traditional approaches that focus on variables and component parts. Instead, we will focus on:

- Expanding the locus of leadership from the isolated, role-based actions of individuals to the innovative, contextual interactions that occur across an entire social system;

- Extending current theory and practice by focusing on micro-strategic leadership actions across all organizational levels and across organizational boundaries;

- Increasing the relevance and accuracy of leadership theory by exploring how leadership outcomes are based on complex interactions, rather than "independent" variables;

- Highlighting the relational foundations of change in emerging organizational fields,

through the idea that leadership occurs in the "spaces between" agents;

- Providing a new and rich foundation for explaining the constructive process of collective action as well as the influential "behaviors" of collective actors;

- Connecting to innovative methodologies that can enrich our understanding of how leadership gets enacted and received in complex environments.

Toward a new era in leadership: Complexity leadership theory

Leadership study, indeed society in general, is infatuated with leaders – people who occupy some elevated status or position and to whom we often ascribe some form of "greatness" (Gronn, 2002). The Western mindset about leaders seems ruled by assumptions that leaders have some innate capacity to plan futures, arrive at rational and correct decisions (Bluedorn, 2002), and control social outcomes (Meindl *et al.*, 1985).

A new mindset is beginning to emerge, however, which recognizes that social processes are too complex and "messy" to be attributed to a single individual or pre-planned streams of events (Finkelstein, 2002; Marion and Uhl-Bien, 2001). As Finkelstein (2002: 77) put it:

"I understand that as researchers we need to simplify very complex processes to study them carefully, but what are we left with when we remove the messiness, the back-and-forth, the reality?"

Although the complexity leadership approach redirects emphasis away from the individual as leader, it does not in any way diminish the importance of leadership as an organizational phenomenon; rather, it recognizes that leadership transcends the individual by being fundamentally a system phenomenon (Marion and Uhl-Bien, 2001, 2003; Uhl-Bien *et al.*, 2004; Hazy, 2006). Drawing from complexity science (Marion, 1999), complexity leadership theory offers a new perspective for leadership research by considering leadership within the framework of the idea of a complex adaptive system (CAS). In such systems, relationships are not primarily defined hierarchically, as they are in bureaucratic systems, but rather by *interactions* among heterogeneous agents and across agent networks.

A CAS is comprised of agents, individuals as well as groups of individuals, who "resonate" through sharing common interests, knowledge and/or goals due to their history of interaction and sharing of worldviews. Agents respond to both external pressures (from environment or from other CAS or agents, e.g., leaders) and internal pressures that are generated as the agents struggle with interdependency and resulting conflicting constraints (e.g., when the needs of one agent conflict with those of another). These tensions, when spread across a network of interactive and interdependent agents, generate *system-wide* emergent learnings, capabilities, innovations, and adaptability. Importantly, such elaborations are products of *interactions among agents*, rather than being "caused" by the specific acts of individuals described as leaders.

A complex systems perspective introduces a new leadership "logic" to leadership theory and research by understanding leadership in terms of an *emergent event* rather than a person. A complexity view suggests a form of "distributed" leadership (Brown and Gioia, 2002; Gronn, 2002) that does not lie in a person but rather in an interactive dynamic, within which any particular person will participate as leader or a follower at different times and for different purposes. It is not limited to a formal managerial role, but rather emerges in the systemic interactions between heterogeneous agents (Marion and Uhl-Bien, 2001, 2003). Therefore, complexity leadership includes a descriptive analysis examining the conditions and dynamic processes of these interactions and the emergent phenomena that they call forth:

"There is a growing sense that effective organization change has its own dynamic, a process that cannot simply follow strategic shifts and that is longer and subtler than can be managed by any single leader. It is generated by the insights of many people trying to improve the whole, and it accumulates, as it were, over long periods." (Heckscher, 1994: 24)

In other words, "leaders" in the *formal* sense can enable the conditions within which the process occurs, but they are not the direct source of change.

A key contribution of a complexity leadership theory is that it provides an integrative theoretical framework for explaining interactive

dynamics that have been acknowledged by a variety of emerging leadership theories, e.g., shared leadership (Pearce and Conger, 2003), collective leadership (Weick and Roberts, 1993), distributed leadership (Gronn, 2002), relational leadership (Drath, 2001; Uhl-Bien, in press), adaptive leadership (Linsky and Heifetz, 2002; Uhl-Bien *et al.*, 2004), and leadership as an emergent organizational meta-capability (Hazy, 2004, 2006).

Specifying the interactive nature of leadership in events

Adaptive leadership is defined for this paper as an interactive event in which knowledge, action preferences, and behaviors change, thereby provoking an organization to become more adaptive. This definition focuses on change, as many definitions of leadership already do (Bryman, 1996), but also distinguishes between leadership (as a product of interactive dynamics) and leaders (people who influence this process). As such, adaptive leadership does not mean getting followers to follow the leader's wishes; rather, leadership occurs when interacting agents generate adaptive outcomes. According to this definition, leadership can occur anywhere within a social system. It need not be authority or position based, but is instead a complex interactive dynamic sparked by adaptive challenges. Individuals act as leaders in this dynamic when they mobilize people to seize new opportunities and tackle tough problems. As the situation changes, different people may act as leaders by leveraging their differing skills and experience.

An excellent starting place for developing a model of adaptive leadership in events can be found in the work of Mead (1932, 1934, 1938), who brought to the fore the neglected dimension of inter-subjectivity in the establishment of both individual and collective behavior. For Mead, the very notion of self (identity) becomes intimately connected to the identity of agents (objects and individuals) with which one interacts in a social structure. Allport (1954, 1962, 1967) builds on this idea by conceptualizing social structure as an ongoing *cycle* of events. Events are the observable nodes in these cycles; multiple cycles may interact directly or they may be tangential. Allport's theory provides a powerful precedent to complexity science in affirming that longitudinal analyses of interaction events should replace cross-sectional frameworks that purport to examine how single variables "cause" some dependent (pre-assigned) outcome.

Weick's (1979) social psychology of organizing modernizes Allport's analysis. Weick argues that the basic unit of organization is the "double interact" of interdependent behaviors between individuals. He also emphasized that "events in organizations are held together and regulated by dense, circular, lengthy strands of causality perceived by members" (Weick, 1979: 13).

Recently, Cilliers (1998) applied a complexity, postmodern lens by connecting these earlier ideas on intersubjectivity to Giddens's (1984) partly cognitive model of structuration. An event is thus a bracketing of ongoing interactions to create meaning. Following this reasoning, we propose a new definition for an event, namely a perceived segment of action for which meaning relates to *interactions* among actors. All of the actors need not play equivalent roles in the action, but all of the roles are interrelated. Another way to say this is that meaning emerges in the "spaces between" people rather than in the acts of individuals *per se* (Buber, 1970). "In essence… [Buber's work] points to the relational perspective that self and others are not separable… but are, rather, coevolving…" (Bradbury and Lichtenstein, 2000: 551). In a similar way, Drath (2001: 136) proposed that:

"people construct reality through their interactions within worldviews... [They do it] when they explain things to one another, tell each other stories, create models and theories… and in general when they interact through thought, word, and action."

Accordingly, leadership events are not constructed by the actions of single individuals; rather, they emerge through the interactions between agents over time.

Drivers of adaptive leadership
Collective identity formation as a driver of adaptive leadership

According to most complexity researchers, agent interactions are governed by rules and mechanisms for changing rules. One fundamental form of rule change occurs when interactions in leadership events produce a new identity (e.g., Gioia *et al.*, 2000). According to the

adaptive leadership perspective, this identify formation occurs over time, as participants together define "who we are" and what we are doing through our interactions. In this way, the emergence of a social object occurs through the "in-forming" of a joint social identity. Importantly, such social objects arise jointly, through the mutual interactions of its participant creators. This driver of collective identity formation can be forgotten as soon as the participants create a common-sense conception of a formal leader "out there," with themselves holding complementary follower roles (Kahneman and Tversky, 1972). By this account, complexity leadership theory suggests that participants need to be made aware of this dual process of identity creation and projection, in order to take back ownership of their role in the identity-formation process.

Complexity leadership theory's conception of interactive events offers the potential for specifying the construction process of collective action, and thus collective actors (Seers and Wilkerson, 2005). Note how different this conception is from traditional models of leadership, and from most complexity models of agent rule following. Most simulation researchers suggest that agents are governed by a selfish rule (Bonabeau and Meyer, 2001). For example, Nowak *et al*., (1995) show cellular automata simulations in which selfish behaviors of agents may, under certain circumstances, generate cooperative behaviors across an interactive system. In contrast, complexity leadership theory develops a more nuanced view of how rules are used and how they can change through interactions over time.

Tension as a driver of adaptive leadership

A second driver of innovation in adaptive leadership events occurs when the interactions between agents spark tension that leads to adaptive change. According to complexity leadership theory, when agents interact they may experience tension in the form of pressures on and challenges to their personal knowledge base (Carley and Hill, 2001). Such challenges to agent schema can, under the right enabling conditions, foster realignment of agents' cognitive maps to resonate better with the new information. That is, agents realign their schema in order to accommodate and thus mitigate disagreement (Kauffman, 1993; Marion and Uhl-Bien, 2001).

These tension-related accommodations often generate completely new information; that

is, ideas, innovations, and frameworks emerge that are unanticipated given the information currently available (Uhl-Bien *et al*., in press). Therein lay the seeds of adaptive leadership: Agent interactions can generate tension through which novel information can emerge; when those new ideas lead to positive change, adaptive leadership has occurred. In this case, the tension that arises in agent interactions can function as a core driver for change in adaptive leadership. Adaptive leadership then may take advantage of such tension as a driver through which interacting agents (people, ideas, etc.) address complex challenges in ways that produce new patterns of cognition and behavior. But how do we measure these dynamics, and how can we expand our understanding of leadership in events such that formal leaders can help create the conditions for adaptive leadership and complexity leadership?

Measuring the space between: Methods for exploring and analyzing leadership events

Given our interest in exploring the events that generate leadership, we have identified several methods that can be used to measure and analyze specific leadership events over time, as well as the interrelationships that enact them. Specifically we are interested in "episodes" of leadership, and on the interactions that are bracketed into those events. Since interactive dynamics are processes that take place over time, we need methods that attend to the longitudinal and dynamic nature of interactive events and the relationships that construct them.

Focusing on events as the prime unit of analysis means more than applying new methods in order to analyze cross-sectional data on individual characteristics. Instead, measuring "the space between" involves:

- Identifying and bracketing the events, episodes, and interactions of interest;
- Capturing these events or interactions as data in a systematic way;
- Gathering individual/agent level data that describe interaction cues received over time;
- Modeling these data in ways that highlight their longitudinal and relational qualities;
- Analyzing these data in terms of their relational

qualities and longitudinal dynamics.

Identifying and bracketing events need not be complicated, depending on the nature of the organizing processes one is examining. A paradigmatic case is Barley's (1986) examination of interactions between radiologists and technicians during a period of dramatic technological change. In that case, the context of these interactions was defined (bracketed) by a radiological procedure, which in our case would be the event within its nexus of relationships. Less common, but no less interesting, is the research on organizational meetings or special events, in which the crucial episodes are defined *a priori* by the research interest, and the bracketing of these processes is structurally produced and distinguished by the organizational members themselves.

Capturing events and interactions systematically may result from the in-depth exploration of organizing processes. For example, management researchers have recognized the important role that temporal events play in making progress (Brown and Eisenhardt, 1997) and catalyzing changes (Gersick, 1994) in dynamic contexts. In those two studies, the researchers were able to identify temporal and event-based transitions that structured the development of the project/venture being studied. A more formal approach was taken by Lichtenstein *et al.* (2006) in their discovery of an "emergence event" within a nascent entrepreneurial venture. Using grounded theory (Strauss and Corbin, 1993), they coded bi-weekly interview data into four categories, then transformed these codes into a quantitative format (Van de Ven and Poole, 1990). Next, they analyzed each of the time series' using quality control methods, which highlighted a dramatic change in one variable (Dooley and Van de Ven, 1999). *Post-hoc* heuristic tests confirmed the presence of two distinct "epochs" (events) within these data. The interview corresponding to the specific change point was more deeply examined; it became the nexus of a series of changes that were explained as interdependent aspects of an emergence event.

Gathering individual/agent level data about the members' interdependencies and the interaction cues that they receive over time (traditionally, the cues that "lead them") is necessary for exploring how leadership events diffuse through "the space between" the participants to influence a population. These data can be gathered through observation and surveys in the laboratory (Guastello *et al.*, 2005) or in the field (Schreiber and Carley, 2005). To fully understand leadership events, however, it is also necessary to know how these leadership cues or triggers are perceived by the individual agents who must make particular choices or take specific actions (Hazy, 2006). Because events unfold over time, the data set must be longitudinal, to capture how these qualities change over time, as well as cross-sectional, to understand agents' perceptions and qualities at specific moments in time. Accessing and gathering this type of data is challenging; fortunately, software tools and other techniques enable detailed data gathering at regular intervals in organizations (www.leadershipscience.com; Amabile *et al.*, 2005). Once gathered, the data can be used as inputs to computational models as described below or for other quantitative, qualitative, or mixed method analytic techniques.

Modeling data in ways that highlight their longitudinal and relational qualities enables exploration of the complex and interrelated dynamics inherent in leadership events. A recent survey of computer modeling approaches in leadership research (Hazy, in press) identified several different techniques that have been used for this, including system dynamics modeling (Davis, 2005; Hazy, 2004; Jacobsen and House, 2001), discrete event simulation (Jiang and Burton, 2002), agent-based modeling (Black and Oliver, 2004; Black *et al.*, 2006; Carley and Ren, 2001), network modeling such as the NK Model (Solow and Leenawong, 2003), and dynamical network analysis (Schreiber and Carley, 2004a, 2005a). These techniques can be used to explore the nonlinear relationships resident in the data and to better understand the analytical implications of theory. Based on these synthetic results, computational analysis can pose research questions and identify hypotheses for empirical studies that might have otherwise gone unnoticed.

In addition, computational modeling can be used to answer questions that are normative or plausible. Plausible questions ask "what might be" and explore or go beyond what has transpired (Burton, 2003). Computational models are particularly useful in respect to research on organizational complexity, as real-world complex adaptive systems do not lend themselves to controlled experimentation. Through simulation, we can explore the complex effects of explanatory vari-

ables in a systematic way.

Analyzing data with a focus on their dynamics and interdependence is also a critical element of research that explores a complexity science perspective on leadership. Nonlinear dynamical relationships inherent in the data create new challenges in data analysis. In addition to the variables that have been measured in traditional research, such as individual traits or behaviors, new metrics must be identified that more fully capture the system dynamics. This is a work in progress and offers opportunities for methodological research. In addition, new analytical techniques must be developed.

One such technique for rigorously understanding these relational dynamics is dynamic network analysis. The new dynamic network analysis methodology combines techniques of social network analysis with multi-agent simulations (Carley, 2003). Dynamic network analysis represents sociotechnical systems in terms of the complex relational qualities that characterize the interdependencies of the system (Krackhardt and Carley, 1998). Also, dynamic network analysis models dynamic changes resulting from natural evolutionary processes such as learning (Carley and Hill, 2001) and strategic intervention processes such as altering the set of individuals within a group (Schreiber and Carley, 2004b). Through the use of dynamic network analysis, the contextual nature of the network and emergent structure and behavior, including leadership events, can be analyzed as well as the effects of emergence on outcomes such as performance, innovation, and adaptability.

In addition, nonsimulation methods are being perfected for developing rigorous longitudinal analysis of critical events in emergence over time. An exemplar is the study of events leading to the emergence of the Branson, Missouri community (Chiles *et al.*, 2004). Their data analysis methods (see pp. 504–506) include grounded theory, pattern matching, visual mapping, narrative techniques, temporal bracketing, and quantification using an event count model analyzed through a Poisson regression. This approach resulted in the identification of four specific eras of emergence punctuated by a carefully defined series of events; moreover, the researchers were able to generalize from these events four drivers of organizational emergence – fluctuation dynamics, positive feed-back dynamics, stabilization dynamics, and recombination dynamics – which may be applicable as elements of adaptive leadership and complexity leadership.

Conclusions: Implications for organization science

By looking for leadership as emerging endogenously within interactions while being embedded within organizations, so-called leaders are not assumed to be directing collective action. There is no linear cause-and-effect relationship to discover. Instead, "leadership" becomes a term that is descriptive of certain social forces at play among actors, which may include a formal leader. This view is consistent with Giddens's (1984) duality of structure in that social structures produce and in some sense lead collective action, while at the same time being reproduced by those actions over time. By considering "leadership action" from an endogenous, time-dependent perspective, we are better able to integrate the time dimension of social systems into organization theory, revealing a unique method for addressing Radcliffe-Brown's (1952) challenge to sociological theory: "How do new types of social structure come into existence?" (cited in Burrell and Morgan, 1979: 56).

Complexity leadership theory begins to address this issue by arguing that certain interactions in a social network will have a nonlinear influence on future interactions within the network. As such, leadership actions may be seen as "field"-level effects that potentially catalyze the emergence of new firms (Uhl-Bien *et al.*, in press), proto-institutions (Maguire *et al.*, 2004) or organizational fields (Chiles *et al.*, 2004). "Field" is being used here in a cognate sense to that found in physics; that is, a matrix underlying a social grouping whose influence reaches to all the actors within that "field."

Another application for complexity leadership theory focuses on how leadership events may occur within and/or give rise to emergent nodes in a social network. Such an approach presents a unique addition to research on networks, by exploring how and when certain nodes may be highly leveraged within a collective social system. Moreover, by exploring influential nodes in terms of leadership outcomes – rather than in terms of the individualized roles these nodes might repre-

sent – complexity leadership theory may offer a new way to explain the role of individual action in the enactment of structures of constraint and opportunity (Ibarra *et al.*, 2005: 359).

Complexity leadership theory also reflects a new approach to understanding dynamic organizational capabilities, including innovation, strategic alliance making, and merger and acquisition capabilities (Teece *et al.*, 1997; Eisenhardt and Martin, 2000). Teece (2005) has argued that the next horizon of management research is how to manage and lead an organization's dynamic capabilities. In our view, leadership is the emergent result of interacting individuals such that behavior and resource elements of the organization come together in useful ways – a frame that can be formalized in terms of dynamic organizational capabilities and routines. Such a link between leadership and organizational capabilities has recently been explored through computational modeling (Hazy, 2006).

Such framing reflects the growing use of computational modeling in organization theory (Carley and Prietula, 1994; Carley and Svoboda, 1996; Levinthal and Warglien, 1999; March, 1991; March and Olsen, 1976) and the use of complementary modeling techniques in leadership research (Hazy, 2006). Of particular note is the use of Kaufmann's (1993) NK model in organizational contexts (Levinthal, 2001; Levinthal and Warglien, 1999) to explore strategic choices and top management team dynamics. Although that approach has been focused around strategic search, innovation, and learning (e.g., Rivkin, 2000, 2001; Siggelkow, 2001, 2002), Siggelkow and Rivkin's (2005) approach comes close to modeling the microdynamics of leadership.

Moreover, complexity leadership theory accepts the juxtaposition of order and apparent chaotic change as an essential characteristic of social environments; in this way a complexity framework for leadership is fully integrated within the social psychology of organizing (Weick, 1979; Weick *et al.*, 2005). Similarly, by framing leadership as emergent and thus endogenous, it can be usefully explored from both the interpretivist and the functionalist traditions of organizational analysis (Burrell and Morgan, 1979).

Complexity leadership theory also offers an important middle ground between computational analyses of individual agents, and the structures that emerge through their interactions. It explores the actions and events that catalyze emergent structures, and by reducing dependence on the individual the new theory expands our explanations about the origin and directionality of transformative change.

The practical and managerial implications of complexity leadership theory are legion; we offer here just a few initial suggestions. By focusing on how leadership may occur in any interaction, this new perspective dramatically expands the potential for creativity, influence, and positive change in an organization. More than simplistic notions of empowerment, this approach encourages all members to *be* leaders – to "own" their leadership within each interaction, potentially evoking a much broader array of responses from everyone in an organization. Complexity leadership theory provides a clear and unambiguous pathway for driving responsibility downward, sparking self-organization and innovation, and making the firm much more responsive and adaptive at the boundaries. In turn, significant pressure is taken off formal leaders, allowing them to attend more directly to identifying strategic opportunities, developing unique alliances, and bridging gaps across the organizational hierarchy.

Complexity leadership theory generates new managerial strategies, including the use of tension to create adaptive change; that is, when lower-level tensions are induced in the organization to produce adaptive change that addresses the complex challenges facing the organization (Uhl-Bien *et al.*, in press). Goldstein (1994) first showed how internal tension, carefully introduced, could help spark transformative change; Uhl-Bien *et al.* (in press) convincingly argue that Jack Welch was a consistent user of management by tension during his tenure at GE. Many more practical suggestions may be garnered through this approach.

Making interactions and relationships primary creates a new avenue for improving ethical and behavioral standards in an organization, for it is much easier to identify a set of appropriate rules for interactions between individuals than it is for someone (who?) to distinguish between appropriate and inappropriate leadership behaviors. Complexity leadership theory also provides a pathway for respecting diversity, not only through its formal emphasis on heterogeneity, but also because cultural respect is much easier to cultivate through

one-on-one interactions than it is to consistently enact through one-to-many leadership exchanges.

In conclusion, Scott's (2004) reflections on the nature of emerging organizational trends argue for increased attention to the relationships through which organizational activity is conducted. Whereas leadership research has been focused on durable, distinctive properties of entities, a complexity-inspired model of leadership in events presents an alternative conceptual framework, based in relationships, complex interactions, and influences that occur in the "space between" individuals. As such, it reflects the complexity of the real world, increases the relevance of our leadership theories, and provides new insights for students, researchers, and managers in the complex world of business.

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