Complexity and the Nexus of Leadership

Leveraging Nonlinear Science to Create Ecologies of Innovation

Jeffrey Goldstein, James K. Hazy, and Benyamin B. Lichtenstein

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CHAPTER 1

INTRODUCTION: A NEW SCIENCE OF LEADERSHIP

During the initial panic of the "Great Recession of 2009" John Chambers, the CEO of Cisco Systems, told the *New York Times* of a crucial lesson he had learned nearly a decade before from Jack Welch when he was CEO of GE.[1] Chambers had asked, "Jack, what does it take to have a great company?" Welch responded, "It takes major setbacks . . . by that I mean, a near-death experience!"

Well, in 2001, Cisco nearly did die when the tech bubble burst and Chambers's leadership came under question. Yet, in 2003, when it became clear that the company had passed the test, Welch called Chambers and told him that he now had a great company. "It doesn't feel like it," Chambers replied. But at that very moment, in responding to Jack Welch, he finally understood what Welch had meant back in 1998: organizations that face and survive serious challenges can emerge stronger. This, of course, is only if they don't fail!

What distinguishes companies that emerge stronger from those that fail? The key lies in how innovation supplies additional capabilities for adroit action in the face of unexpected and rapidly changing conditions. Firms that can't innovate go the way of dinosaurs. As a major ingredient in adaptability, innovation means much more than introducing new products or services, although without those no organization can compete in this economy. Truly adaptable organizations must also innovate their practices, processes, strategies, and structures so that their internal capacities become a match for turbulent environmental conditions. Staying competitive in the twenty-first century requires a higher level of innovation and adaptability than most of us have ever seen, and the bar keeps rising. Achieving this is simply not possible through traditional top-down

management fiats, nor by "shared" or "distributed" leadership that is being sold by so many books and consultants these days.

So, how can such high levels of innovation be achieved? This book provides a new answer to that critical question by showing how leaders, guided by the insights coming out of complexity science, can create *ecologies of innovation* throughout their organizations. Leaders in an ecology of innovation encourage and support "experiments in novelty," building new organizational pathways that allow these experiments to materialize into novel offerings and improvements. Complexity science thus puts leaders in a greatly enhanced position to help their organizations effectively navigate critical periods of growth and change.

A Complexity Science of Generative Leadership

Our book presents a host of insights coming from complexity science about how ecologies of innovation can be created. Over the last decade or so, nonlinear science researchers have developed tools and concepts that more accurately explain how organizations operate, how leaders can be more effective within them, and how innovation really comes about.

In particular, complexity science shows how the typical focus on "heroic" and charismatic leaders can result in a *lack* of innovation in modern organizations.[2] In contrast, we reframe "leader" and "leadership" as referring primarily to *events* rather than to people. Through a series of interactions over time, *leadership events* alter the underlying framework of engagement. They change the rules by which individuals interact, influencing the ends to be achieved, such as where a work group is headed, as well as the means by which it gets there.

A complexity science – based view sees leadership as an influence process that arises through *interactions* across the organization: leadership happens in "the space between" people as they interact. Through influential interactions, which are happening all the time in every corner of the organization, novelty emerges and is enacted in unique and surprising ways. This means that the true catalysts of innovation are the webs of relationships—in the nexus of interactions that connect members to each other and to others in the environment.

We are using the term "generative leadership"[3] to highlight that the process of innovation is not led by any one individual but emerges through an unfolding series of events at every level of the

organization. Generative leadership focuses on the mutual influence that occurs within every exchange. Accordingly, rather than concentrating on how a supervisor expresses influence *over* an employee, generative leadership sees them *both* as expressing leadership. Moreover, generative leadership refers to capturing the benefits of this mutual interplay as a *generative* process—it spawns new opportunities that increase the organization's potential for novelty, flexibility, and growth. As a process that builds progressively, generative leadership tunes into *patterns* of interaction rather than specific "one-time moves" that a manager may initiate and carry out.

Generative leadership does not wait fatalistically for the unexpected to happen, but instead actively participates in and coevolves (more on this term later) with the environment and the future. *Complexity and the Nexus of Leadership* shows the usefulness of this new understanding of leadership through research findings from complexity science and through many cases and examples from a wide range of corporations, entrepreneurial start-ups, social ventures and NGOs, and governmental agencies.

Complexity Science Empowers Leadership

One of the most important takeaways from this book will be just how empowering are the new advances in complexity science for leadership. What we mean by the term "complexity" is not the same as what most managers are taught to fear, and therefore try to undo. In technical terms, "complicated" describes, for example, the design and manufacture of a jumbo jet, an exceedingly difficult task involving up to two million separate parts and untold operations. In contrast, "complex" has to do with the *interactions* in the system, through which something new emerges, such as norms in a work group or a groundswell of momentum for a new enterprise. Until recently the differences between complicated and complex were not well understood; as a result they have often been treated in the same way, as if the same process should be used to "deal with" situations that are complicated *or* complex. Business schools justified this by treating organizations as if they were machines that could be analyzed, dissected, and broken down into parts. According to that myth, if you fix the parts, then reassemble and lubricate, you'll get the whole system up and running. *But this is exactly the wrong way to approach a complex problem.*

In this book we show precisely why this is wrongheaded: it misses the fact that under the right conditions a complex system can *adapt*, whereas a piece of machinery cannot. A complex system, through its

own internal processes, can actually change itself so as to generate better outcomes. No one would expect an aircraft, no matter how complicated the design, to reconfigure itself so that it flies faster or operates more efficiently! And yet, organizations do these kinds of things all the time. This is a critical difference between complex versus complicated systems that traditional approaches miss entirely. Instead, they talk about performance and efficiency and then add as an afterthought, "Oh yes, you need innovation also, so do that too." Although complex systems are often intricately entangled and complicated with all sorts of factors and people and systems, it is their *complexity* and not their complicatedness that makes them adaptable.

There is one more crucial difference. In a complex system, but never in a complicated one, even a small number of people, working well together, can make a major difference that goes beyond any one of their capabilities. Complexity science empowers individuals by demonstrating how they can alter a system, collectively making new things happen. What is exciting about the advent of complexity science is that it helps explain, for the first time, why some organizations are able to adapt and change and grow, and why others fail the crucial test that Jack Welch posed to John Chambers. In this book we will tell you how you can make this critical difference.

THE ADAPTIVE POTENTIAL OF COMPLEXITY

Complexity science empowers leadership in another way: it presents an *active* and *constructional* model of leadership based on a highly engaged view of mutuality, interdependence, and shared accountability. By "active" we distinguish this book from a spate of "complexity" texts that promulgated a laissez-faire view of leadership; by "constructional" we mean the *hands-on building up* of ecologies of innovation, the construction of more effective social networks, and the search and amplification of experiments in novelty, which result in the emergence of innovations.

This sharply distinguishes our book from the so-called self-organization approach to leadership—the laissez-faire style that has only the most superficial connection to the science of complex systems. This facile notion of self-organization was linked to a somewhat absurd claim: somehow, by dismantling hierarchically directed command and control structures, the organization will spontaneously reorganize "on its own," resulting in positive directions for it. In fact, rigorous complexity science research has borne out the *opposite* conclusion, namely, that any positive result from the emergence of innovation requires both bottom-up and top-down

influences from proactive leadership events. In contrast, tearing down hierarchical structures can easily lead to a morass of unanticipated outcomes, many of which are much worse than what existed before.

Finally it is important to note that organizations have always been complex. What has changed is our ability to understand them as complex systems and thereby influence them. Complexity means that "system components"—individuals, or more generally "agents"—each with a different perspective and information, interact with each other in a mode of mutual influence. In this mode complexity arises when even two agents interact, since their unique information and perspective generates *difference*, and difference leads to unanticipated and novel outcomes. Of course, this is magnified many times across the interactions of 20 or 100 or 1,000 people. Everyone who works in an organization intuitively realizes that social interactions are complex in this way, and yet business schools and most so-called leadership experts have traditionally ignored this obvious fact.

A simple example will clarify the nonlinear and non-proportional effects of this kind of complexity. In a social network with two people there are two connections, one in each direction. With three people there are six possible connections, each person to two others. Five people have 20 connections, eight people have 56 connections. Notice how this buildup of connectivity is not linear; the number of connections increases much faster than the number of individuals. For example, a social network with 100 individuals yields 9,900 possible connections, any number of which can come together to influence the outcome.

This view of nonlinearity helps explain some powerful elements of complex systems. First, as we've said, complex systems are not linear—hence the term "nonlinear" in our title—because a given cause does not lead to a proportionate result. Second, complex systems are not easily predictable, since what emerges from their interactions is something *more* than a simple aggregation of their properties. Third, although complex systems are undoubtedly stochastic (i.e. irregular), they are not random since dynamical patterns are discernible, and these can be acted upon by generative leadership. Indeed, if randomness was the final message of complexity, then this book should be about how to teach leaders to become better gamblers!

It is the very uncertainty, unpredictability, and uncontrollability of organizational processes that signal the adaptive capability of complex systems; their capacity for the emergence of novel practices, processes, and routines is at the heart of an ecology

of innovation. Because of this capacity for adaptability, the complex systems that are of interest are often described as *complex adaptive systems.* Examples of complex adaptive systems include living organisms and ecologies, healthy immune systems, thriving economies, and the sustainable functioning of organizations, whether entrepreneurial start-ups, nonprofit entities, or large institutions and corporations.

In a business or other organization, a complex adaptive system is composed of individuals—semiautonomous agents—who interact according to certain rules. Each individual gathers information about the internal workings of the organization as well as the environment according to that person's own position and history. Individuals in a complex system are necessarily diverse in form, in capability, and in the information they hold and use. Moreover, each adapts more or less effectively by gathering information, learning from others, and changing their own rules or mental models when possible. Whether a group of these learning individuals somehow translates into an organization that is adaptable, though, is a different matter. This is where generative leadership can make the critical difference. In this book we show how generative leadership can build and enhance this capacity for adaptability.

THE CONTRIBUTION OF NONLINEAR SCIENCE

We are claiming that insights from complexity science have the power to reframe leadership and transform organizations, but only when these insights are properly understood. Unfortunately, most leadership or management books that have appealed to complexity science have presented a narrow understanding of complex system dynamics, on the basis of a highly stylized interpretation of a few intriguing outcomes. The result is merely a set of metaphors that fail to deliver any sustainable advice to managers and executives dealing with rapid change.

Furthermore, many previous books in this genre were insulting to the reader by aiming for a lowest common denominator of intelligence and expertise. In contrast, we are assuming that our readers are intelligent, with proficiencies based on years on hard work and difficult decision making. This means that in order to provide the accuracy and value you deserve, the material in this book requires thoughtfulness and imagination. Rather than masking the inherent complexity of organizations by using simplistic interpretations, we will take this difficulty on directly through clear descriptions and vivid examples, visual diagrams, and alternative ways of understanding.

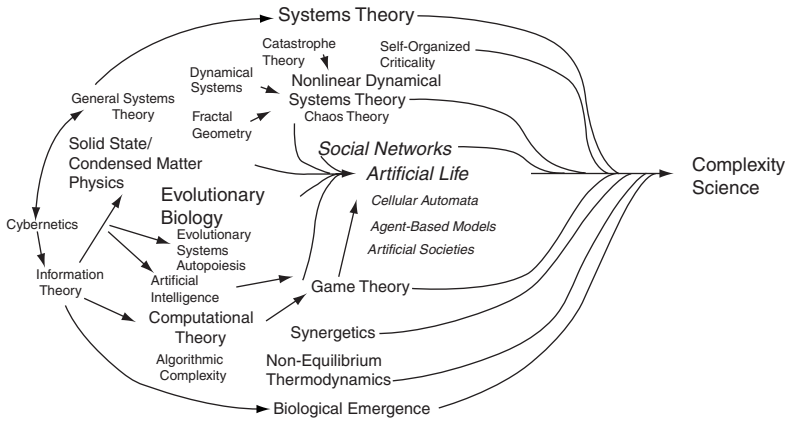

Figure 1.1 Scientific and Mathematical Fields Making Up Complexity Science

To begin, we provide a glimpse of what complexity science encompasses. The various fields making up complexity science are presented in figure 1.1. As this diagram shows, the science of complex systems is the confluence of a number of fields. On the far left we see the original systems sciences of cybernetics, information theory, and General Systems Theory, all of which originated around the time of World War II. These approaches were then extended in the 1960s, 1970s, and 1980s by new theories of nonlinear dynamics in physics and mathematics, order emergence in thermodynamics, the advent of network science, and a great plethora of computational simulation studies. For the past 20 years there has been a literal explosion of complexity research due to the availability of powerful microcomputers and the establishment of institutes and centers around the world that are devoted to the study of complexity science.

Rather than go into the history of complexity science, suffice it to say that in this book we draw on fields that are situated roughly to the right of the center of this whale-shaped diagram. Whereas virtually all other complexity books make use of perhaps one or two fields, our treatment is based on relevant insights from nearly a dozen fields of complexity science. The result is a robustness of theory and application that has a proven track record of success. We now turn to a summary of some of the key themes that are illuminated throughout the book.

COMPLEXITY AND THE NEXUS OF LEADERSHIP: CORE THEMES

To give you a sense of what's to come, we present the main themes of the book, some of which refer to specific chapters and others

that are interwoven throughout the book: Ecologies of Innovation; Interaction Resonance within Social Networks; Differences, Information, and Novelty Generation; Critical Periods and their Potential for Innovation; Emergence; and Boundaries and Constraints.

ECOLOGIES OF INNOVATION

At the heart of our complexity view of leadership is the idea of an ecology of innovation. The science of ecology consists of the study of interactions between ecosystems, eco-subsystems, and their environments. By focusing on the network of interrelations making up an ecosystem within a specific area, ecology employs a whole-systems viewpoint. In an important sense, an ecosystem is the most accurate picture of what a complex, nonlinear, adaptive, and interactive system is all about. Sub-ecosystems are the components in interaction with each other and with other subsystems in the environment; these interactions supply the nutrients, building materials, wastes, and information that get transmitted from system to system in a vital exchange. No sub-ecosystem can survive on its own. Instead, the vast set of interchange and exchange that connects one to another enables the entire ecology to thrive.

It is within this vast web of interconnectivity that we see all the features of complex systems:

- Micro-level diversity supplying seeds of novelty
- Experiments that move parts of the system away from normal routines
- Intricate networks connecting interdependent subsystems to one another
- Innovations conferring new functionalities that enhance adaptability to unexpected changes or "jolts" from the environment
- Critical periods of instability that allow for substantive transformations of behaviors and dynamics

Recent complexity science and ecology research has uncovered some key patterns in ecologies—regularities that help sustain a thriving ecosystem within a continually changing environment—insights that we describe in detail in the next chapter.

Since ecologies are driven by all of the exchanges, interchanges, interactions, and connectivities existing between its subsystems, whatever is essential takes place at these interfaces. That is why interactions, as first spelled out in Chapter 2, are so important to our approach. This concentration on interaction should not be taken

merely in the sense of distributed control, but instead highlights how innovation itself relies on the "space" between systems as where novelty has its most fertile environment.

By an ecology of innovation we recognize that every organization occupies a niche within its communities, customers, suppliers, strategic partners, and competitors, and this places constraints on the organization's choices. This means that information is being discovered all of the time, by many people in many specific situations. The information first appears in a specific context, and it is often difficult to recognize and comprehend and is easy to lose. This prompts the question of how an organization can learn to distinguish signals of imminent change from the constant level of noise inherent in day-to-day activity. That is one of the key themes of this book, and one of the main areas in which complexity science can help all of us. In chapters 2, 5, 6, and 7 we provide ways to think about this issue and tools to help individuals do exactly this.

An ecology of innovation offers one more conceptual advantage: it can be understood at many different scales of resolution. For example, a desert can be viewed at the scale of tiny lichen on shaded rocks or on the wider scale of small cactus growing near dried rivulets or on a wider scale of small rodents scurrying among the rocks on the north side of desert mountains away from the sun or on the larger scale of the slow changes in the weather that may occur as one season haltingly changes into another. The same is true of organizational ecologies. Thinking and acting can occur at many different levels of scale, and since complex systems are inherently nonlinear, what happens on a microscale may have a large impact on a macro- or even collective scale.

Interaction Resonance within Social Networks

At the core of ecosystems are patterns of interactions—the vital exchanges—that connect all the subsystems together. In complexity science, interaction is a web of positive and negative feedbacks among components. Because a complex system is composed of interdependent, interacting subsystems, information about the functioning of the system is distributed throughout the networks of connection. This is why generative leadership focuses attention on the nexus of relationships linking individuals within the social network. This nexus of relations is the source of influence, the driver of innovation, and the regulator of change.

In social systems, interaction shows itself in the prevalence of social networks that connect the components of any system, a topic

we explore in depth in Chapter 7. Every social network has a structure that reflects the configuration of how people are linked with one another. These networks extend not only within an organization but throughout its entire ecology, as well as into the environment. Arguably, an individual's professional success in business and in other fields is determined as much or more by the scope and quality of their network connections than by their individual competence. These networks of interaction, although largely ignored in Business Schools, are central to our view of generative leadership.

Although communication has long been an important topic in leadership practice and management education, the specific nature of how information can be enriched as it is exchanged has not received the attention it deserves. From our complexity science perspective, we are calling the process of information enrichment *interaction resonance*. It is largely through interaction resonance that the kind of micro-level diversity that we discuss in the next section expresses itself as those experiments in novelty that are at the core of innovation. Interaction resonance is described in Chapter 2, and it is a theme that winds its way through our entire presentation of innovation, particularly in Chapter 3, in which we suggest that interactions are central to "critical periods" of change, and in Chapter 7's explanations of social networks, which are the context in which interaction resonance takes place.

DIFFERENCES, INFORMATION, AND NOVELTY GENERATION

One of the hallmarks of a complex system is its heterogeneity, that is, the vast diversity of components, agents, and parts, each involved in an ongoing variety of distinct interactions with the others. These differences create novelty since the interaction of two identical things cannot generate something new. We conceive of organizations and their leadership as complex systems that operate from as well as produce great differences, which in turn allow for innovations to emerge.

In the original version of information theory, information referred to the "important" bits of a message in a communication channel, as opposed to "noise." Later, the idea of information was generalized to be patterns of redundant order mixed with elements of *surprise,* thus expanding information to include the *differences* among a range of patterns. Information in social systems plays a role similar to the role played by energy in physical systems, namely, it is the "life blood" that flows through organizations and connects them to systems in their environment. In this way information is meaningful—it literally carries meaning throughout a system.

In organizations, meaning emerges through the *differences* in members' backgrounds, skills, opinions, and perspectives; these differences help drive innovation, a theme we'll return to in Chapter 3. Our use of the term "information" throughout this book thus includes formal facts contained in textbooks and reports but also surprises from events, experience, or experiments.

Pushing this analogy further, the catalyst for innovation lies in deviations from what is expected, that is, experiments in novelty reflecting departures from the currently accepted and conventional ways of functioning. These experiments are constantly going on in organizations, although such deviations are typically unnoticed or marginalized. Complexity science has shown that this micro-level diversity, when it is noticed, amplified, and disseminated by generative leadership, can emerge as novel patterns, practices, and strategies that can improve and transform organizations. These emergent phenomena, which we discuss in chapters 3, 4, and 5, introduce new qualities into the system that are neither expected, predictable, nor deducible from the preexisting components.

An issue, therefore, for leadership working with complex systems is to determine which micro-level deviances possess a potential for significant emergent innovation. In chapters 5, 6, and 7 we describe several ways in which generative leadership can approach this issue, including a type of social network called "intercohesion" which makes it more likely that micro-level diversity with the potential for innovation is recognized and amplified.

In Chapter 6 we describe a particular kind of difference with innovative potential, termed "positive deviance," a unique framework that links the constructive term "positive" with the usually negatively term "deviance." We show that major innovations and transformations have, in one way or another, relied on radical departures from what is expected, and these are justifiably examples of "positive deviances." Leadership can use the tool of positive deviance as social intervention that helps social systems identify and amplify novel experiments that have previously gone unnoticed, but whose problem-solving and opportunity exploitation potential can be unleashed.

Critical Periods and Their Potential for Innovation

Another feature of complexity science, and an important theme in this book, is how complex systems can dramatically transform during critical periods. We use the term "criticalization" to refer to major transitional periods, which have important implications for generative leadership. Complexity science insights from criticalization

are drawn from phase transitions – when matter transforms from one state into another, the emergence of new dynamics – when the connectivity structure of a social network is changed, the emergence of new order in self-organizing physical systems – when some critical parameter value is reached, and the emergence of new attractors – when nonlinear dynamical systems *bifurcate* or split into two separate stable states. We will be alluding to all of these critical phenomena in chapters 3, 4, and 7.

Customarily, criticalization is understood as a system that moves away from equilibrium or normative functioning, and in so doing leaves behind stability while opening to novel and unstable states. These conditions of disequilibrium and instability may be unsettling, but they are necessary for the complex system to undergo deep transformation. Indeed, a system ensconced in a stable condition will reject any fluctuations that may lead to novelty, and as quickly as possible it will return to its original stable state. In contrast, complexity science shows that it is only when a system is unstable—especially in a period of criticalization—that internal changes can move it to a new regime of activity.

Criticalization is the essence of the anecdote at the beginning of this chapter: as Jack Welch told John Chambers, critical periods are what define an organization. They separate the companies that are truly great from those that merely survive. It is during critical periods that the strength and proficiencies of an organization's leadership are truly tested, and it is during these periods that the organization most needs its leadership to step up to the task. Complexity science shows that the key difference between success and failure is generative leadership, which effectively guides an organization to embrace the "critical period" instead of trying to avoid its effects. In Chapter 3 we describe how this was done in the transformation of IBM under CEO Lou Gerstner[4] as well as at Imagitas and Oracle, and in Chapter 5 we describe the various strategies leading to expansion at Starbucks when it engaged several critical periods.

Change management consultants sometimes describe the need for leaders to "manufacture a crisis" as a prerequisite to a successful change management effort; however, in our experience we have found that employees and all the other stakeholders see through such artificial moves. Instead, generative leadership positions the organization so that it can recognize and take advantage of significant changes in the environment. A key task of generative leadership at every level is to enable and encourage a vital connection between an organization and its changing environment; it is only when such connections are engendered that critical periods can offer

the potential for renewal and emergence that are the hallmark of long-term success.

Successful criticalization leads the organization into a stronger era—the company becomes better matched to its markets and better able to change with them in the future. It requires that the organization develop new capabilities that facilitate a new pattern of interaction between its members. If used in the right way—if one can be in a state of "surfing forever on the edge between never stopping but never falling"[5]—then the organization has the potential to engage in the unique process of emergence itself.

Emergence

Emergence, one of the most exciting and relevant areas of research in complexity science, refers to the arising of novel structures, patterns, or processes in complex systems. For example, the emergence of new attractors is discussed in Chapter 3, the emergence of new structures with new properties is covered in Chapter 4, and the emergence of new forms of social cooperation in social networks is described in Chapter 7. The study of emergence in social systems is especially apt given the plethora of new kinds of organizational forms: joint ventures, strategic alliances, social entrepreneurial organizations, and other forms of collaboration.

Emergent phenomena seem to have a "life of their own," with their own rules and possibilities. Emergence is about the arising of the radically novel—unpredictable and not deducible from its components; thus, emergence is the essence of innovation in organizations. Both emergence and innovation supply additional functionalities to a complex system, providing the system with a much greater repertoire of possible actions and processes. Much of the current work in complexity research centers such as the Santa Fe Institute is built around emergence, because systems that emerge gain a significant adaptive advantage in their environment.

Emergence comes about through a recognition, amplification, and dissemination of those seeds of innovation that come from micro-level diversity or experiments in novelty. Thus, a primary objective of generative leadership in facilitating emergence is to foster and amplify novelty generation within an ecology of innovation.

Among the different prototypes of emergence found in complexity science research that we describe in Chapter 4, we are especially attentive to the "dissipative structures" model studied by Nobel laureate Ilya Prigogine through nonequilibrium thermodynamics and

the German physicist Hermann Haken in his School of Synergetics, biological emergence such as found in Lyn Margulis's idea of "symbiogenesis," and social emergence through the formation of cooperative teams and similar phenomena.

As we have explained, earlier approaches to emergence in organizations strongly coupled it with a particular notion of self-organization understood as a supposedly spontaneous process. This view, however, resulted in the mistaken belief that leaders could be passive and simply allow emergence to take place, once command and control mechanisms were relaxed. More rigorous research and experimentation have proven that emergence hardly comes about spontaneously—instead, it demands rigorous containing, constraining, and constructional operations. Accordingly, our interpretation of leadership's role in emergence is not passive, but instead is active and generative.

BOUNDARIES AND CONSTRAINTS

One counterintuitive result from complexity science is that adaptability can emerge only if there are constraints or boundaries that consistently operate on the choices and actions of the individuals in the system. A good example comes from complexity researcher Peter Allen, whose longtime studies of fish populations in the North Atlantic and showed that boundaries and constraints in the ecosystem enabled many new species to develop and persist. He called this effect "micro-diversity" and claimed it was critical to the ecosystem's ability to respond and adapt to change.[6] Certain species did better under changing conditions, whereas a previously dominant species might flag under the change. However, since one replaced the other in the food chain, the ecosystem as a whole adapted and continued to prosper, albeit with a different mix of species.

Similarly, it takes a constrained complex system to encourage and maintain the information differences within individuals. These constraints, from external boundaries or between functions, act like the nooks and crannies in the seabed of the North Atlantic, serving to protect and nurture the ecology's most important resource, namely, informational differences.

If not for constraints of some kind, organizational members would not be motivated to organize in new and different ways, and no new structures would emerge. An example is the implementation of Sarbanes-Oxley reporting requirements, or any law or regulation that limits the degree of freedom in which the organization and its members can operate. New routines and procedures have had

to emerge to address these new constraints, and these in turn have changed other aspects of the organization so that the process could be supported effectively.

In a similar vein, for adaptability to emerge in a complex system, the right *context* is also important to the mix, a topic that we discuss in Chapter 3. For generative leadership, context is as important as content. The distinction between context and content can be understood through an analogy from semantics.[7] In the *context* of everyday talk, a "daughter" is a female descendant and "left" can mean, in political discourse, the more liberal point of view. A comment such as "the daughter of that family tends to veer to the left" has a rather unequivocal meaning: the female descendant of that family has political leanings that are more liberal than conservative. But in a different context such as nuclear physics, "daughter" refers to the immediate product of radioactive decay of an element, and "left" is a direction, not a political stance. In this context, a comment such as "the daughter of that family tends to veer to the left," made by a nuclear physicist to her colleague, means that a "family" of elements undergoing nuclear decay tends to move toward the left side of the experimental screen.

Most managers learned to lead through interventions that are aimed at directing and controlling followers' activities. In contrast, generative leadership is more interested in the *context* or *parameters* of organizing, the internal and external organizational environment, and the opportunities and constraints it generates. Far more than the substance of daily tasks and goals, it is the *context* of organizational interactions that determines the potential and quality of members' contributions.

At the same time, organizations need managers and executives to take responsibility for specific business goals and outcomes. This presents the conundrum of how a manager may have an influence on their part of the system while being a generative leader who allows influence to flow throughout the entire organization. Exploring this balance is an issue that hovers within every chapter. The suggestions we make are put forward as avenues for reflection and action for the thoughtful and committed reader.

Conclusion

In summary, *Complexity and the Nexus of Leadership* offers a view of how individuals at all levels can make a difference in their organizations through the practice of generative leadership. The key to generative leadership lies in creating ecologies of innovation in the

workplace, in which experiments in novelty lead to innovative practices, processes, and routines, enabling an organization to become adaptable to the unprecedented levels of change characterizing today's business environments.

The remainder of this book unfolds as follows: the next chapter, Chapter 2, presents a 50,000-foot view of why organizational life has become so difficult to navigate in recent years. With global supply chains and Internet connectivity, the age of the stand-alone business that runs like a machine is being replaced by one in which organizations exist in a network of partnerships that looks much more like an ecological system than a complicated machine. We draw on complexity research to explore how ecologies work, as well as the critical role played by interaction resonance—our term for effective, two-way information flow—the key enabler of adaptation within ecologies. After this high-level overview, we proceed to the core of the book, chapters 3, 4, and 5, wherein we provide a complexity perspective on what is actually happening within an ecological system when organizations collide, and why, at times, organizational life seems so difficult and uncertain. The good news is that the complexity actually provides tools to make sense of this confusion. Here, we explore the challenges—and rewards—associated with the nonlinearity of influence among individual human agents who act within organizations and ecological systems. Chapters 6 and 7 provide ideas, behaviors, and actions to empower individual human agency within the above complexity. These chapters speak from the individual's perspective and suggest specific actions that will enable the thoughtful executive to practice generative leadership and implement the insights in this book. The end of Chapter 7 brings back and again highlights the importance of interaction resonance as a key enabler of the entire process. In Chapter 8 we provide a summary of the key takeaways that the reader might have identified throughout the book. We are hopeful that this chapter can also serve as a refresher, a resource that you can return to again and again as you develop your skills in the practice of generative leadership.

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We emphasize that generative leadership recognizes the folly of trying to solve organizational problems through feats of personal heroism. Instead, complexity science shows how to engage all the members of an organization through enhanced network connectivity and interaction resonance. Differences in perspective are encouraged to coexist and persist since out of them come the seeds of innovation.

This book presents the most significant findings in the field of complexity science applied to leading the dynamics of innovation.

We discuss how these approaches are already in use in the successes of Google, Apple Computer, Starbucks, and Merck, as well as many other entrepreneurial firms and nonprofit organizations. Our hope is that you'll find many ways to apply them to your company within the first week of reading the book. With that in mind, we turn to Chapter 2, which introduces the fundamentals of ecologies of innovation.

Notes

1. Chambers, J. T., & Bryant, A. (2009). Openers: Corner office—In a Near-Death Event, a Corporate Rite of Passage. *New York Times.* August 2, 2009, p. 2 Business.
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