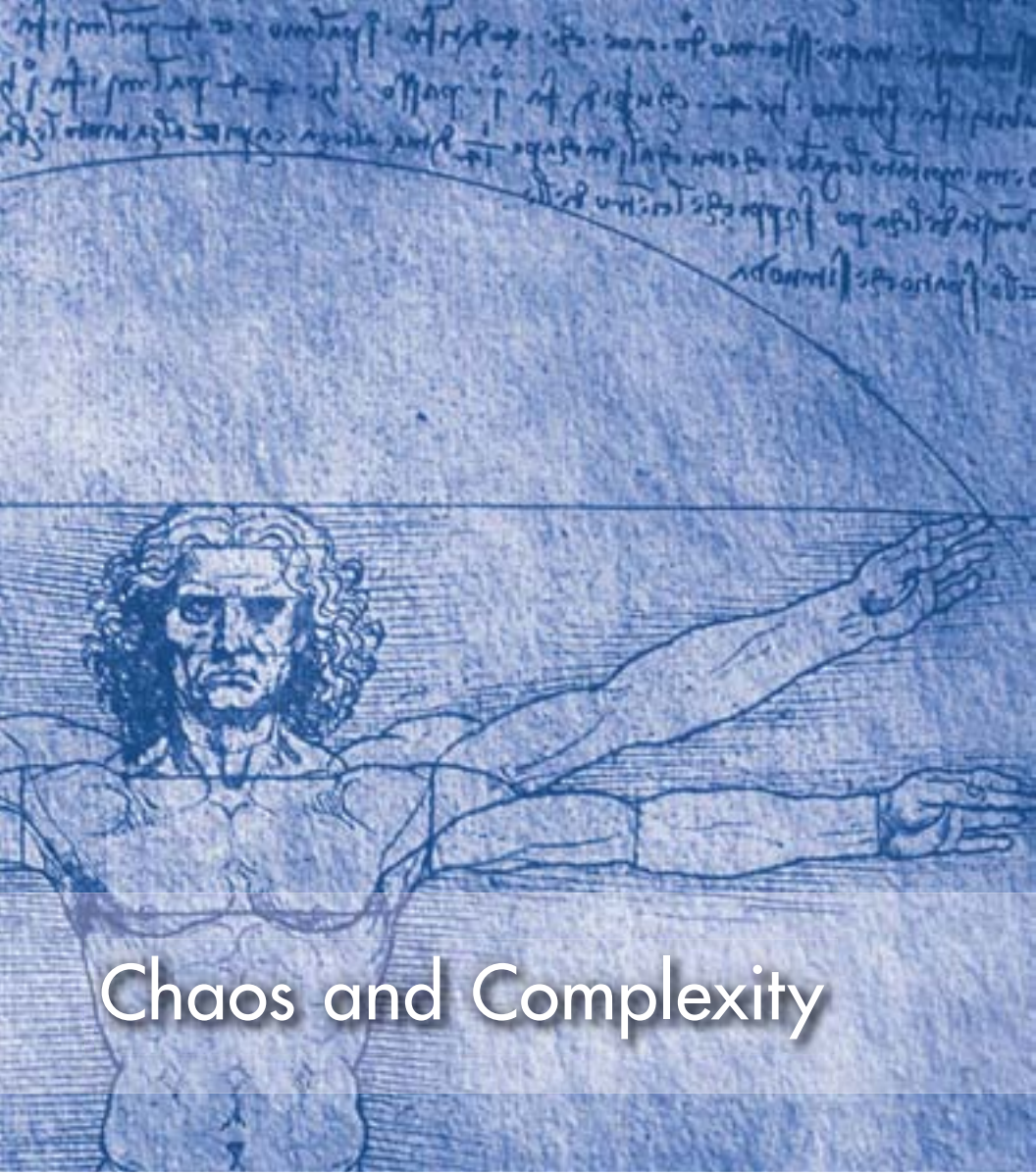


Chaos and Complexity

Applying Concepts From Complexity Science to Quality and Organizational Improvement

ASQ
Human Development & Leadership Division

Chaos and Complexity

Bruce A. Waltuck

"I believe that the 21st century will be the century of complexity."

— Stephen Hawking

If a consultant came to your workplace and asked if you were willing to spend every day in a state of chaos, it is likely that your first response would be an emphatic "no." To most of us, the word chaos connotes a state of affairs in which there is no order, predictability, stability, and no obvious way back to an ordered state. In short, we would tell the consultant "no thanks," and wonder how anyone seeking money for their advice could possibly suggest such an option.

The quote above, however, may give us a first glimpse of another, and probably unexpected, possibility. Stephen Hawking is arguably the greatest mind of the second half of the 20th century. Why would the world's pre-eminent astrophysicist talk about complexity? What does chaos have to do with complexity? How does any of this relate to the work of improving quality, leadership, and organizations?

When we feel that we really are in a state of chaos, we often feel anxiety. We lack the information, understanding, and the ability to move forward toward whatever objective we have in mind. As leaders, change agents, and employees, we are likely to resort to the known and familiar — even if we realize that what worked for us in the past does not seem to be working in the present.

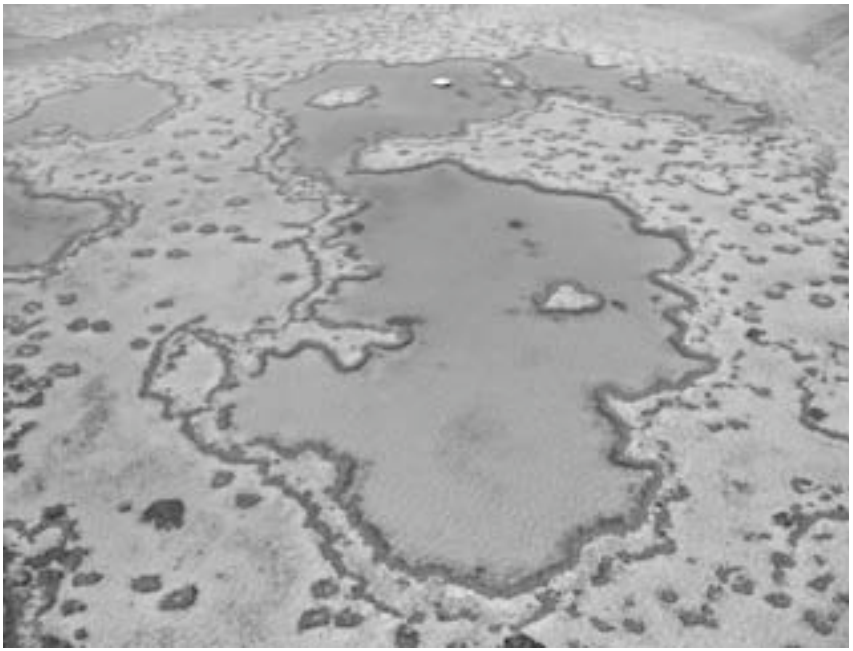
This primer provides a brief introduction to the world of chaos and complexity science. It will help you understand the contemporary meaning of these terms and explain some of the important ways that complex systems behave, and it should lend insight on why *The Wall Street Journal* and other publications have reported, "As many as three- fourths of change initiatives such as TQM…fail."[1]

With that foundation we'll begin to explore the implications of this perspective on the work of quality and organizational improvement. Finally, we'll describe some complexity-inspired methods and tools that you can use to influence positive change in your organization.

What Do We Mean by Chaos and Complexity?

"The world is not chaotic; it is complex." [2]

Great Barrier Reef, Australia. Complex interactions of land and water over time create emergent visible patterns.



Chaos

Everywhere in the world are systems that seem to behave in "chaotic" ways. In his popular book, *Chaos,* author James Gleick noted, "…chaos appears in the behavior of the weather, the behavior of an airplane in flight, the behavior of cars clustering on an expressway."[3]

For thousands of years, cultures around the world believed that chaos and order were inextricably linked. Now, that does not seem to be the prevailing modern viewpoint. What happened to change the way we view chaos and order? How did we come to see chaos as separate and distinct from order?

The answer lies in the famous story about an Englishman sitting under an apple tree. In Isaac Newton's world, things could be differentiated, analyzed through calculation, then integrated and put together again. Over time, people came to view everything through the lens of Newton's mechanistic perspective.

When people began to study management and organizational behavior, it seemed logical to apply the Newtonian perspective and the methods of science that enabled great human advances for centuries. In 1947 the social psychologist and systems theorist Kurt Lewin wrote "…an organization is static; that a change agent studies and acts outside the system; and that the system returns to a state of equilibrium after the intervention."[4]

According to Briggs and Peat, before the recent examination of chaos and complexity, "scientists have long admitted that outside the laboratory our world is seldom as Euclidean as it seems…turbulence, irregularity, and unpredictability are everywhere…."[5] Elizabeth McMillan has written that the "…emergence of complexity science…had profound implications for…a world-view based on Newtonian thinking. Complexity now challenges the predominant scientific tradition." [6]

Discoveries in the natural and social sciences began to shift the view of Newton's world. In the behaviors of cells in a Petri dish, bubbles of steam in a boiler, and computer simulations of weather, a new and seemingly paradoxical form of order revealed itself. Unlike Newton's rules that said a system would dissipate over time, certain systems — notably human organizations — increased in complexity over time. Margaret Wheatley reports that the Nobel Prize-winning chemist Ilya Prigogine "demonstrated that any open system has the capacity to respond to change and disorder by reorganizing itself at a higher level of organization." [7]

Wheatley points to the ways that an understanding of chaos and complexity can transform the practice of leadership and organizational change. She writes that a system can descend into chaos and unpredictability, yet within that state of chaos, the system is held within boundaries that are well ordered and predictable. [7] Briggs and Peat have similarly written that "Chaos science focuses on hidden patterns…and the 'rules' for how the unpredictable leads to the new." [5]

Complexity

Vladimir Dimitrov, a complexity theorist and professor at the University of Western Sydney, explains that the word "complexity" originates from the Latin word *complexus* which means "totality;" the science of complexity explores the totality of dynamics [in systems].[8] Michael McMaster clarifies the distinction further, writing that "Complexity has been described as 'at the edge of chaos' [where] patterns can be seen…but the rich interplay of individual elements cannot be reduced…"[9]

We are concerned mainly with the dynamics of a certain kind of complex system. These are frequently called "complex adaptive systems." Such systems are complex in that an analysis of the parts will not explain the behavior of the whole. They are adaptive in the ways that the system is capable of learning and responding to changes in its environment. The source of the complex, non-linear dynamics in such systems resides in "difference"— that is, the fact that we each experience and interpret the world differently. The expression of these differences, and our differing intentions that follow, generate dynamic patterns of communication, sense making, and action.[10] These complex adaptive systems simultaneously are affecting and being affected by the environment around them. McMaster points out that "the challenge for a complex intelligent system is to continually develop both the ability to adapt to the competitive environment and the ability to influence that environment. McMaster notes that this is an "iterative and seemingly paradoxical ability."[9]

We can begin to notice the difference between systems that are complicated and those that are truly complex. Making a car or a cell phone is complicated, but the process is fundamentally linear. If you start at the beginning and follow each step, you will always wind up at the end with the car or phone you intended. The weather — or the behavior of people trying to improve leadership in an organization — is not predictable moment to moment; however, over time our observations reveal a general pattern and general boundaries of behavior.

"It is in the emergence of meaning that we find the will to act."

— Dick Knowles

Characteristics of Complex Systems

As researchers in both the natural and social sciences have explored complex systems, they found a number of common behavioral characteristics. In the limited space of this primer, we cannot give too much detail about each of these characteristics. This overview, however, should help you view the complex human dynamics of organizations through a new lens and point to the ways we may work as change agents in a complexity paradigm.

Autonomous Agents

Have you ever been stuck in a traffic jam on a busy highway? You have certain information from your perspective behind the wheel. You can see a bit down the road, you know how fast you and the cars in front of you are moving, and you know where you want to go. So, from your point of view, you are acting autonomously — independent of the other drivers. It is easy to see in this example that there are both enablers and constraints affecting your actions. In organizations, despite the constraints of various rules, we are still free (to some degree) to act autonomously. The individual agents in a system (you and me in our organizations, for example) interact more or less locally. As we'll see in the sections below, the patterns of our local actions add up to more than the sum of their parts — also typical of complex systems. Flocks of birds, schools of fish, and people in communities or workplaces — all exhibit these complex patterns of behavior.

Far From Equilibrium

This characteristic also is called "the edge of chaos." In the manufacturing world, we often apply the tools of statistical process control. We want the processes and systems with which we are working to be stable, predictable, and controllable. We want everything the way we designed and intended it to be, but complex systems in nature do not want to be in that zone of equilibrium. They operate the way turbulent bubbles of water do inside a steam boiler. There is an optimum level of activity inside the boiler. This produces bubbles of just the right size for maximum efficiencies in carrying steam through the system. Boilers all have a visible window on the side, showing the level of the bubbling water.

The best steam bubbles are not produced in the middle point of equilibrium. Instead, the most effective interaction of heat and water is produced at the height just before the system breaks down into total chaos (and energy inefficiency). We can look at the glass tube outside the boiler and see that the best place for this system to operate is far from equilibrium — at the edge of chaos. [11]

In human organizations, systems respond to increased energy inputs with higher levels of interaction. This can be communication or the exchange of information. Pascale and his colleagues wrote "…in the face of threat, or when galvanized by a compelling opportunity, living things move toward the edge of chaos. This condition evokes higher levels of…experimentation, and fresh new solutions are likely to be found." [2]

Self-Organizing

Earlier we mentioned flocks of birds and schools of fish. No one tells them how to behave together. They follow a few simple rules that each individual understands, and they self-organize into the patterns that we recognize. Your behaviors and those of the other drivers in the traffic jam example are another instance of how agents in a system self-organize. [12]

In her book, *A Simpler Way,* Wheatley wrote, "When simple relationships are created, patterns of organization emerge." [13]

Emergence

When we go back to the factory floor and see cars or cell phones in production, we know before the first parts are connected what the final product will look like. In contrast, the patterns of interaction in complex systems are non-linear. They don't follow the exact same steps every time. When we create a complex, non-linear system, we often establish certain rules for the agents in the system. This is similar to you being behind the wheel in the traffic jam. You have to obey speed limits, go the right way on the road, avoid collisions, and so on. From your viewpoint, you can see only a small part of the whole roadway traffic system; however, from the view of the reporters in the traffic helicopter, hovering far above you, patterns are observed. These patterns are emergent properties that occur from the iterated behaviors of the locally-interacting agents

in the system. In other words, understanding the behaviors of the individual agents in the system will not enable you to predict the emergent patterns that appear in the system as a whole.

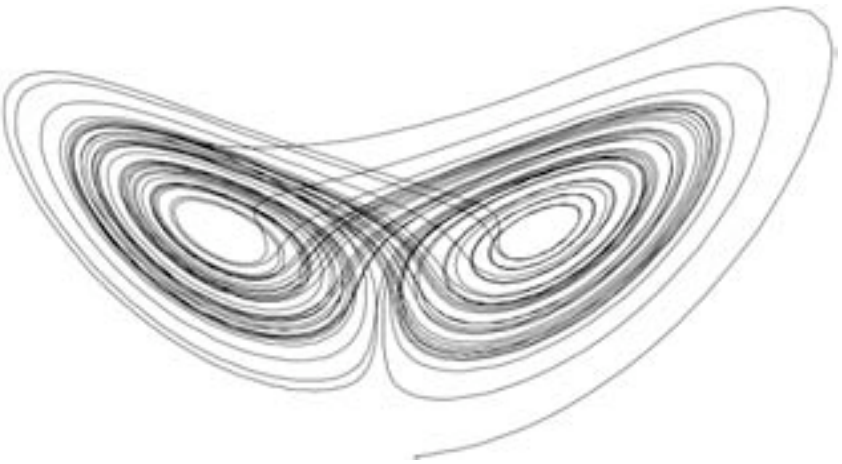
Attractors of Meaning

Have you ever joined in a popular fad? What made you vote for the candidate you chose in an election? The behavior of complex systems, just like your behavior in these examples, is influenced by the fields of various attractors.

Like magnets, these attractors may push or pull us in our actions within the system, and in varying degrees of force. Physicist Fritjof Capra observed that when you look at the results of a complex system, you observe "a visual shape, a pattern…known as an attractor." [14]

In the complex landscape of our organizations, there are multiple attractors of meaning that constantly are present and changing. An understanding of the patterns of attractors in an organization helps us think about how to influence change.

Lorenz Attractor. This famous discovery of meteorologist Edward Lorenz shows how very small differences in initial conditions create complex fields of patterned behavior known as attractors.



Sensitivity to Initial Conditions

There is a famous saying that "you cannot step into the same river twice." The swirl of water flowing through the stream is never exactly the same from moment to moment. The dynamics of daily life and change inside our organizations are much the same. We might seek to replicate the success of a certain team or a method that worked well for another firm. Then we scratch our heads and wonder why things did not go as planned. We must remain aware that "similar to" does not mean "same as." For the change agent, the sensitivity of a complex system has useful implications.

Fractal Patterns

We have begun to understand how simple rules, repeated over and over, create highly complex patterns of behavior. In nature, we observe the ways that a certain type of pattern creates many shapes we take for granted. From the main trunk of a tree its network of branches follows a simple basic pattern. We see this kind of pattern in the shapes of mountains, coastlines, or a head of broccoli. IBM scientist Benoit Mandelbrot called this kind of patterning process "fractal." These fractal patterns have the characteristic of being self-similar at varying scales in the system.

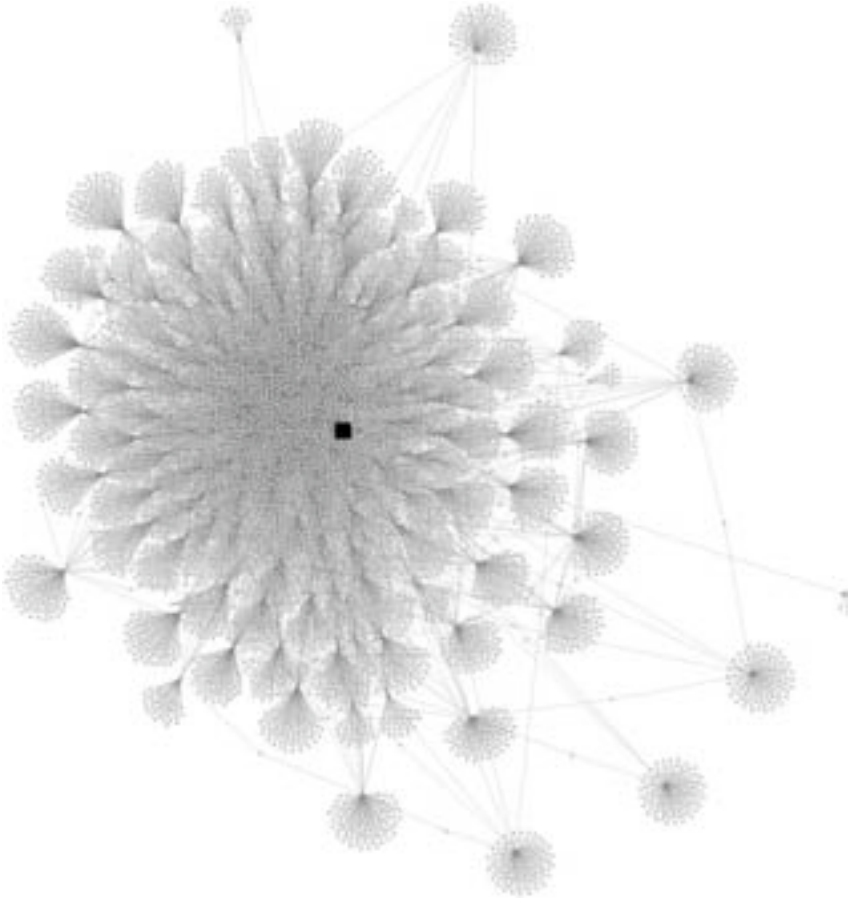
Glenda Eoyang has noted that fractal patterns are a characteristic of complex adaptive systems.[1] With regard to organizational dynamics, Eoyang writes that these "patterns of behavior or relationship appear in multiple places and times across the organization."[1] Wheatley has written, "…all organizations are fractal in nature… deeply patterned with self-similar behaviors evident everywhere."[7] A number of computer systems have been created to map out the relationships in social networks. The resulting maps exhibit fractal patterns and often reveal important details about key relationships.

Bifurcation

As complex systems function over time, they may seem stable. Outputs may appear clear and predictable, but at certain points, the system's whole pattern

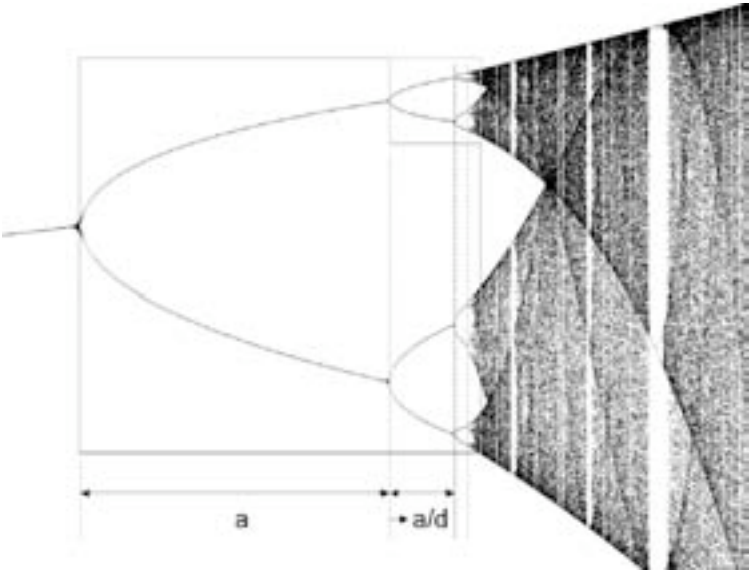
seems to shift suddenly. Making a hot cup of tea shows us the way a system can shift suddenly. The molecules of water in the pot respond to the increasing heat and pressure in the pot, and at a certain level of energy and interaction, "…the system rockets into a new behavior."[15]

Social network diagram shows fractal self-similarity. This graphic mapping of connections within a social network shows patterns that are fractal or self-similar at varying scales. Used with permission of Valdis Krebs from "So many people, So little time," http://www.thenetworkthinker.com/2009/01/so-many-people-so-little-time.html.



In popular business literature, we have become familiar with the phrase "tipping point" from Malcolm Gladwell's book of the same title. The tipping points that Gladwell describes are points at which the system or organization bifurcates — splits, moves to a new level of energy, interaction, and behavior. Most of us have observed moments in organizations, communities, or personal relationships when situations seemed to suddenly jump to some new pattern of behavior.

Bifurcation. From left to right, we can see the points at which the system splits into new patterns of behavior. Beyond the third bifurcation point, the system displays very complex patterns of possible outcomes. Used with permission of Valdis Krebs from "So many people, So little time," http://www.thenetworkthinker.com/2009/01/so-many-people-so-little-time.html.



Feedback Loops

The steam boiler is designed to keep its operation in the optimal zone through loops of communication. Information about what is happening inside the boiler is constantly fed back to the systems that control the boiler. Heat levels are adjusted up or down as needed. People in relationships and organizations

constantly receive feedback — from parents, teachers, friends, and co-workers. We interpret the feedback and through our words and actions, we respond. The people who gave us the feedback then make meaning of our response and decide what they will do next, and so it goes. The amount of information varies, as does the time needed to receive and respond to the information.[1] Feedback loops can serve to regulate or amplify[15] and provide both barriers to and enablers of change. Methods of connecting more people in an organization and opening the channels of communication and information can affect the behavior of feedback dynamics.

Adaptive

We have described certain kinds of complex social systems as adaptive. This means that the system or organization learns from its experience and responds to changes in its environment. Like a living organism, social systems and organizations adapt to survive. The first Hyundai cars sold in America did not have a very good reputation for quality. Hyundai could have stayed the course and followed its initial plan to build and sell cars based mainly on low cost, but the company learned from customer feedback. They adapted to the changing requirements by placing a greater emphasis on quality. To boost consumer confidence, Hyundai began offering the best new-car warranty in the industry. Hyundai did not become extinct; it grew and succeeded. Today, their cars compare favorably to the best in the business.

With regard to adaptation and evolution, Charles Darwin is quoted famously as referring to "survival of the fittest." In fact, what Darwin wrote was that "it is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change." The lesson applies equally to our relationships, communities, and organizations.

Complexity, Quality, and Leadership

"…competition, we see now, is destructive. It would be better if everyone would work together as a system, with the aim for everybody to win. What we need is cooperation and transformation to a new style of management."

—W. Edwards Deming

In this section, we'll explore the meaning and dynamics of quality and the implications of a complexity perspective for the work of quality improvement and leadership.

Variation

The pioneers of the quality movement built their work on the foundation of understanding variation. The aim of statistical process control is to root out causes of variation, enabling output that is virtually free of defects and which conforms to specification. On a graph, a process deemed statistically "in control" ideally produces a flat line across the page — identically conforming widgets each time, every time. A process output graph that zigs and zags up and down the page might appear to be out of control — even "chaotic" in the broad use of the term.

The pioneers of quality also taught us to seek "continuous improvement." In a manufacturing process, this requires us to examine the various components and dynamics of a process and seek ways to improve production methods or drive down costs. We want our graphs to have flat lines, but at ever-higher levels of whatever we define as "quality." McMaster wrote that quality initiatives are "…renowned for insisting that quality is a way of life and there is no end to the process…of learning and development…."[9]

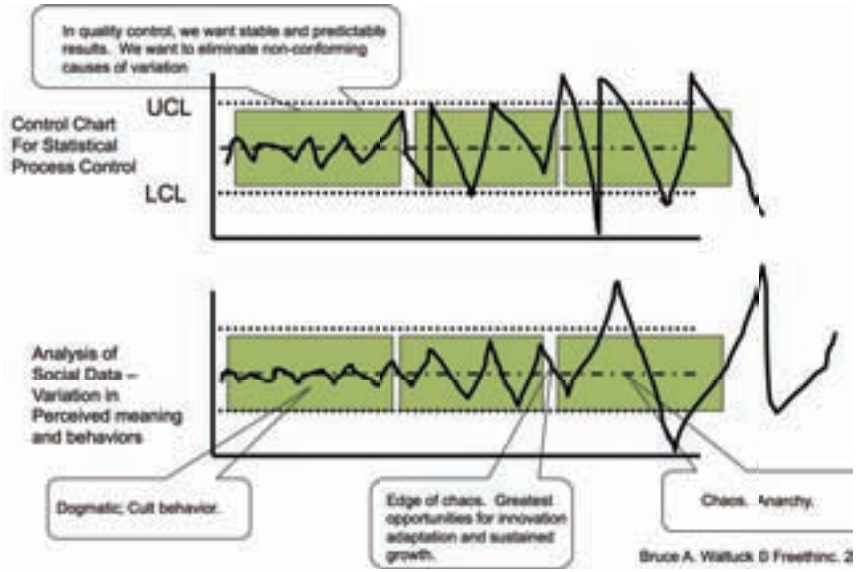
The processes of the shop floor, and even standardized processes of service delivery, tend to be linear. As with making a car or cell phone or delivering your broiled burger "your way," such processes are often complicated but not truly complex. Conversely, the way that humans interact in relationships, communities,

and organizations is decidedly non-linear. Frequently we struggle to manage situations that challenge us with "both…and…" realities. As change agents, we simultaneously are affecting and being affected by any system we observe.

Our view of variation in complex and dynamic organizations becomes very different from the conformity goals of statistical process control. Instead of charting the outputs of a process, we could record the variations in understanding and interaction that are occurring in the organization. We would see quickly that our "social statistical analysis" showed three main patterns of variation.

- If we had a nearly flat line, we would have "conformance to requirements" just as we often do on the manufacturing shop floor. With people, however, this would not be a desirable outcome. With no variation in understanding and no exchanges of information, innovation and creativity would come to a standstill. This would be dogmatic or even cult-like behavior.
- At the other end of our social analysis chart, we might find understanding and information exchange all over the place. Opinions would not yield any sense of consensus, and collective action toward some agreed-upon objective would be difficult, if not impossible. This would be chaotic or anarchistic.
- As with our familiar steam boiler, however, there is a zone of variation in understanding, and this is the degree of communication that provides the best possibility for the emergence of both new ideas and adaptability and growth over time. This is the zone "at the edge of chaos." For those of us in the middle of complex organizational dynamics, the necessity to live "at the edge" means becoming more comfortable with uncertainty and unpredictability. Wheatley cites former business CEO Jack Welch, who said that to achieve sustained growth, "…predicting is less important than reacting."[7] Developing an understanding of the dynamics of variation among the people in an organization becomes a key skill in the work of leadership and influencing change.

Quality and Complexity. This diagram compares the patterns of variation between typical technical/complicated processes and complex behavioral processes. Note that the common desired state in quality control is a nonadaptive stasis in human systems. Used with permission of Bruce A. Waltuck © 2007.



Implications for Change Agents and Leaders

We have begun to see how organizations are "living systems" with complex and adaptive patterns of behavior. So, how should leaders and change agents act within this new paradigm? Again, Wheatley offers a succinct summary, "We have spent several decades attempting to change organizations, communities, and entire nations. We have endured and survived mostly failure from these attempts."[7]

Patricia Shaw, of the Complexity and Management Centre at the University of Hertfordshire, summarizes the challenge, "The question, 'How do we go about changing complex organizations?' often means 'How can we formulate intentions and communicate them as agreed plans of action to be implemented?'"[16] Shaw's

colleagues, Doug Griffin and Ralph Stacey, offer this advice for working with the uncertainty of complex organizations: "Articulate emerging themes; have an enhanced capacity to take the attitudes of others; display greater spontaneity; in other words, an enhanced capacity to think, feel, reflect, and imagine."[17]

In their best-selling book, *The Leadership Challenge,* Kouzes and Posner note, "Credibility is the foundation of leadership."[18] This relates to the complexity concept of "attractors of meaning."[8] Ideas and the meaning we perceive in communicating with others must be sufficiently powerful (whether we are attracted or repulsed by them) as to motivate behavior.

Pascale and his colleagues studied organizations applying the new perspective of complexity. They wrote about organizations as diverse as Sears and the U.S. Army. "The traditional approach does have its place…when the solution is known in advance and an established repertoire exists to implement it."[2] "Harder to handle are those non-routine challenges where discontinuous change is sought. These challenges often demand a leap in capability, solutions are unproven or unknown…. Facing such an adaptive challenge, we must throw out the old notion about how a business should be led, organized, and run."[2,19]

Comparing the experience of being a complexity-informed leader to rafting down the Colorado River, McMaster said, "If you exercise appropriate control — a small steer here, go with the flow there — you find it is quite predictable, and you are in control of all that you need to be in control of to realize your intentions."[20] Change leaders enable the free flow of communication and information and encourage the exploration of "possibility space" while maintaining Deming's "constancy of purpose" and "driving out fear."

According to Shaw, in the end, our ability to be adaptable enables the courage to "act with intention into the unknown."[16]

Tools and Methods

"I would not give a fig for the simplicity this side of complexity, but I would give my life for the simplicity on the other side of complexity."

— Oliver Wendell Holmes

If we understand that organizations behave like complex adaptive systems, then what can we do to influence the processes of change? This section provides a brief overview of methods to influence organizational change, which are informed by a complexity perspective. The limited scope of this primer does not permit detailed descriptions or case studies, but references and additional reading provide an easy road map for further learning.

As we seek useful and satisfying ways to work better together, we are usually trying to answer a common set of organizational questions. Wheatley neatly summarizes these questions, which reflect an organization's capacity to create and sustain effective relationships:

- Do people know how to listen and speak to each other?
- Do people work well with diverse members?
- Do people have free access to one another throughout the organization?
- Are they trusted with open information?
- Do organizational values bring them together or keep them apart?
- Is collaboration truly honored?
- Can people speak truthfully to one another?[7]

The tools and methods described below all seek to answer one or more of these questions.

Respectful Dialogue

The conversations that flow between and among people in an organization both reflect the current reality and help shape the next moment of understanding. Some generate new ways of thinking and acting. Pascale and his colleagues express the belief that "Conversation is the single most important business process when the goal is to shift what people believe and how they think."[2] The art of

respectful and purposeful dialogue is at once ancient and contemporary. Practitioners such as Ken Homer and Harlene Anderson offer useful and practical methods for this work. MIT researcher and author William Isaacs describes dialogue as "…a way of taking the energy of our differences and channeling it…to reach new understanding and…a totally new basis from which to think and act."[21] Current methods of using dialogue as a means for enabling positive change include the World Café and Conversation Café models.[22]

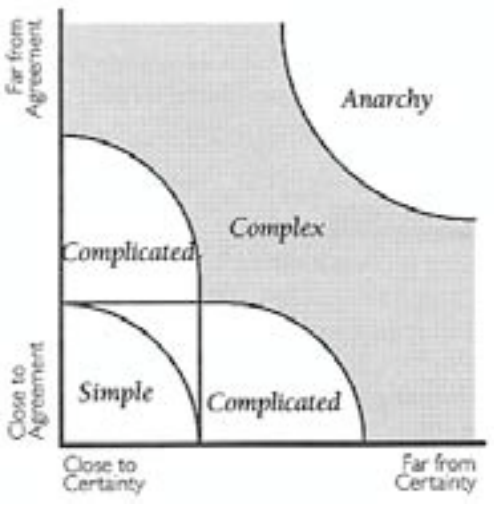
The Process Enneagram™

Richard Knowles has explored the challenges of leading a complex organization. He crafted a model for working with organizations and the human tendency toward "self-organizing leadership." Knowles' model builds on Wheatley's "three critical areas for change: learning more about the identity of the organization, more new information, and crossing boundaries to build new relationships as needed."[7] In 2001, Knowles co-founded the Center for Self-Organizing Leadership to advance the understanding and application of these methods.

Stacey Matrix

Ralph Stacey is considered a leading thinker about complexity and management. His matrix helps us understand the interplay of agreement and certainty. The emergent landscape of possibilities suggests that the best chance for sustained growth is again "at the edge of chaos." Stacey's colleague, Shaw, writes about the experience of being a change agent in the midst of organizational complexity. She describes that experience in the context of Stacey's theory of "complex responsive processes of relating."[16]

Ralph Stacey Certainty and Agreement Matrix. Forms of management and decision making are based on degrees of certainty and agreement Optimal adaptability and innovation appear "at the edge of chaos" with certain levels of uncertainty and disagreement. Used with permission of Zimmerman, Plsek, and Lindberg.



Large-Scale Change

When we convene teams to address issues in our organizations, the teams are typically small in number. Standard texts on team dynamics suggest that convening very large groups can be unwieldy and unproductive. However, the methods of some change experts suggest that the self-organizing dynamics of complex human systems can generate innovation and growth even at very large scales. Some well-known methods for large-scale change include Open Space Technology, Future Search, and FutureScape.

Simple Rule Sets

Computer simulations model the complex behaviors of flocking birds with just three simple rules. Simple rule sets can enable the emergence of complex

patterns of both structure and flow in organizations. A set of just six core principles was the foundation for the U.S. Department of Labor's (DOL) Employee Involvement and Quality Improvement system (EIQI). Within a few months of implementation, thousands of DOL employees self-organized into highly successful process improvement teams.[23]

Positive Deviance

In any organization, no matter what the rules and procedures are, some people will do things their way. Not all of these deviations from the expected norm will yield superior results. As they studied infant mortality rates in Vietnam, Jerry and Monique Sternin found some villages with noticeably superior results. The purpose of the positive deviance approach is to find, define, and replicate these positive deviations from the prescribed norm.[2] This has a clear connection to quality improvement methods such as Kaizen and to Deming's "constancy of purpose," which seek continuous improvement.

Eoyang's Tool Set

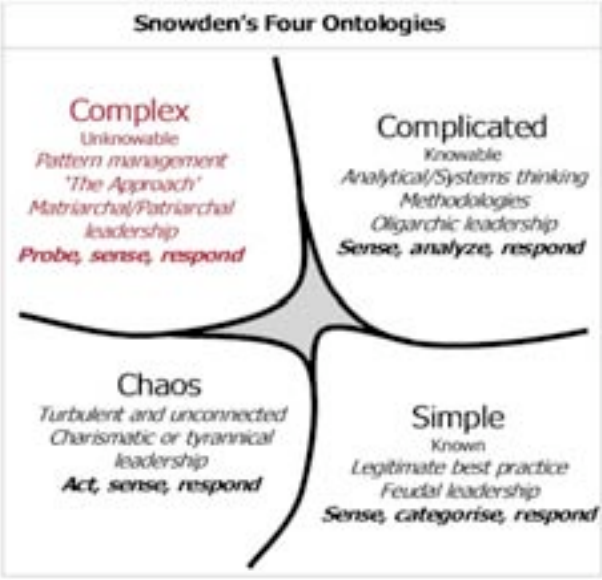
Eoyang, an author and consultant, describes herself as "pragmatic." This is very evident in the set of complexity-inspired methods she describes in her book with Ed Olson, *Facilitating Organization Change*. Eoyang's work gives the change agent practical tools to apply new understanding to the work of facilitating change. The methods in this book build on self-organizing dynamics, feedback loops, uncertainty, nested (fractal) levels of self-similarity, and co-evolving patterns. For those seeking comfort in some sense of certainty — at least about the complexity tools they will use as change agents — Eoyang's work provides a useful kit.

Snowden's "Cynefin" Model

In 2007, Dave Snowden and Mary Boone published a widely read article in the *Harvard Business Review* describing Snowden's "Cynefin" model for thinking about and responding to types of organization and leadership challenges. Snowden distinguishes among simple, complicated, complex, and chaotic types, and offers

differing patterns of response for each centered around probing/inquiring, sense-making, and action.[24] Snowden offers a wealth of additional information on using the Cynefin model through his website and in short videos posted to the YouTube website. The principal types — the pairings of simple/complicated and complex/chaotic — also relate to the distinctions drawn between "technical" and "adaptive" challenges in the work of Harvard's Ron Heifetz. The Snowden and Heifetz work offers excellent tools for leading and facilitating change in complex environments.

Dave Snowden Cynefin Model. The Cynefin model describes simple, complicated, complex, and chaotic situations in organizations and how to respond to them.



Through the Lens: A brief sampler of complexity-inspired change methods

Richard Knowles Process Enneagram®

In his book, "The Leadership Dance" [25] Richard (Dick) Knowles describes the development and use of his nine-step Process Enneagram® model for change in organizations. Shown as points around a circle's edge, with corresponding arrows linking one to another, the Knowles model builds on the dual foundations of practical process management, and the complexity of human behavior in organizations.

Dick Knowles' model is built on three inter-related dimensions of organization dynamics: Identity, Relationships, and Information. These in turn are linked through three pairs of additional related aspects of organizational culture and behaviors: Intention and Tension (issues); Principles and The Work; and Deep Learning (sustainability) and New Context (structures; strategies). In working through the Knowles model, participants typically follow a certain pattern and sequence through the nine dimensions. This sequence parallels the famous "world's shortest change model" of "What? So what? Now what?" It also parallels the well-known Deming cycle(s). The Knowles model seeks to integrate the more concrete or technical aspects of change (characteristics of the work/mission; new structures and strategies), with the more complex human behavioral aspects of change (tension between stated intention, underlying principles, and current action). When groups work through the model in this way, they will probe and explore both current and possible future states of their organizational identities; their working relationships; and the flows of information among them.

Tim Dalmau, a consultant and teacher from Australia, is a long-time colleague and associate of Dick Knowles. Tim's website contains excellent examples of how the questions for using Dick's model can be simply structured for different organization and business challenges. Please see the link below to view Tim's "Enclave" and other papers. There, you will see specific examples of how this method can be used for challenges ranging from strategic planning, to workplace safety process improvement. Especially recommended is Tim's recent

piece on the "Middle Way" which he presented at a UK conference on complexity and business. It is a synthesis of Tim's experience with Dick Knowles' model, and Tim's understanding of the work of other leading complexity thinker/practitioners. Link to Tim Dalmau's web site and collection of resources on Richard Knowles' Process Enneagram®
http://www.dalmau.com/resources.html

Glenda Eoyang, Human Systems Dynamics

Glenda Eoyang, together with Ed Olson, wrote the book "Facilitating Organization Change." Building on Glenda's dissertation work, this book offers very practical tools and methods for change from the complexity perspective. As Glenda wrote on a 2010 blog entry:

The questions continue to be, "What can you do if you cannot predict and control? How can you prepare for an unknowable future? What are the differences that make a difference, and how can we build them into our individual and collective patterns?"
http://sourcepov.wordpress.com/2010/03/20/org-complexity/

The Eoyang/Olson response is a model they call Human Systems Dynamics (HSD). Note that in their book, the authors make explicit reference to TQM and the quality improvement movement, noting that despite the many achievements of the TQM method, it was difficult to address the underlying complex dynamics of lasting organizational change.

The Human Systems Dynamics model describes the following three main domains of organizational life, and suggests pragmatic methods to facilitate positive change: "Containers" are the fields of activity and understanding that define the system and problem you want to address. What is it that you want to improve or change? Where is it happening? Are there boundaries that currently define what is
in or out of this "box?" (as we often talk of "out of the box" thinking).

"Differences" are the differences between the current behavior of the system and the behavior you want. Through a process of inquiry and meaning-making, you decide which is the "difference that most makes a difference." This, Glenda Eoyang teaches, is where to place the focus of your change efforts.

"Transforming Exchanges" are the sharing of knowledge, and the application of resources, that shift understanding, and drive movement away from the status quo (and hopefully, towards desired outcomes).

In her book "Coping With Chaos: Seven Simple Tools" [26] Ms. Eoyang gives the analogy of a manager in complex situations being like a farmer. She describes the similarities, in the ways that farmers understand and balance the many complex variables affecting annual production. Planting, watering, fertilizing, reaping – all, in Ms. Eoyang's view, require the "farmer" – manager to be aware, informed, and take the most effective actions under the circumstances.

In her brief description, we begin to see how Glenda Eoyang's approach to complexity works in the real world. We see the "containers" of the complex farm system- the farm and its network of suppliers and production resources. We see the "differences that make a difference" affecting production in complex and unpredictable ways. The "transforming exchanges" occur when information passes from farm to farmer, and back again through the farmer's responses/actions. These exchanges intend to create "differences that DO make a difference" in the intended direction of the organization's vision and strategy.

We notice the difference between this HSD approach, and the traditional methods of a manage-and-control approach. A traditional management style might set goals for farm production, and plan precise costs and deployments of resources. Variations in growing conditions, or in productivity, might be viewed as "special causes" not as learning opportunities, but as problems to be solved (or worse yet, ignored as "outliers").

One critical aspect of adopting a complexity perspective, which Eoyang also notes, is that a leader's or change agent's perspective is not an "either…or…" choice. Rather, there are aspects of each improvement/change challenge that are predictable, and other aspects that are not. The change agent's true challenge lies in being able to see both sets of dynamics working together, and in being able to respond to each in a useful way.

Bruce Waltuck: Simple Rule Sets and Emergent Consequences

A large nationwide organization wanted a completely new system for improving key business processes, quality and results. At the time, the prevailing approach was Management By Objectives (MBO). This approach had senior leadership set strategy and goals for the year ahead. These goals cascaded down to local managers. As Dr. Deming and others noted, this approach had two significant and unintended consequences: 1)MBO provided no incentive for ongoing quality and process improvement; 2)MBO provided strong incentives for managers to do anything they could – even making up false results – in order to meet the goals.

At the time, I was familiar with Total Quality Management and the ideas of Dr. Deming. I had also worked inside the organization's MBO framework for many years. This organization had six principal business units accounting for 90% of their 15,000 employees. But the missions and cultures of these business units were themselves very different from one another. A "one size fits all" approach to quality and process improvement, would not work. A typical MBO-style mandate to improve quality and results, would not address the deeper organizational culture patterns that dominated each business unit's behavior.

Instead, the design that my colleague and I chose, drew on the behavior of complex systems. Flocks of birds, and schools of fish, behave in very complex ways. Yet they are governed by a few very simple rules of behavior. There is no central leader, and responsibility for alignment to the group's objectives, is distributed among everyone in the group.

The design we chose was based on six months of our research. Reviewing organizations that succeeded, and others that failed in their own quality improvement efforts, showed us that "success leaves clues." There were a small number of core principles that provided the basic framework for each agency to build and sustain a process improvement initiative. The principles we used included:

- Focus on process, not people.
- Base decisions on data and fact (and today I'd add that this is mainly for technical/complicated process problems)
- Use a structured approach to problem-solving
- Use respectful dialogue to explore different viewpoints, and seek

agreement on decisions

- Establish a minimal governance system, in which a dyad of labor-management appointees in each unit, oversee improvement activity

As we expected, employees nationwide self-organized into quality and process improvement teams. Within six months there were over 220 improvement teams at work. Significant savings in time and money were achieved through the work of these teams.

Over time, the patterns and work of these improvement teams revealed several emergent behaviors. The two most significant were: 1)several powerful "command and control" style managers resisted the empowerment of subordinates in crafting process improvements; 2)improvement teams were not using the experience of their improvement projects, to learn and drive further improvements.

In a traditional hierarchical management framework, top leadership would have simply mandated the compliance of recalcitrant managers. That might have changed the behaviors from a surface perspective. But the deeper patterns of norms and values held by the resistant managers would not have changed. The ability to sustain the improvement initiative would be impaired. Rather than issuing a mandate, the complexity perspective led us to address the rule set driving the system.

While we had given managers and staff the empowerment to create quality and process improvement, we did not have feedback loops for either the responsibility to support the initiative, or the accountability for the change. Again, we wanted the maximum distribution of empowerment and responsibility. We designed simple feedback and communication loops, involving peers and the union-management governing pairs, to both inform and influence others.

In a similar way, we added a rule to the basic set, simply saying that each improvement project needed to report data and opportunities for further improvement, on a regular basis. Without a mandate for specific additional projects, employees still continued to self-organize and self-select improvement projects. The new reported information provided valuable guidance to subsequent generations of improvement team efforts. This work continued for nearly a decade.

In designing rule sets for change and improvement, you should consider:

- ✓ Do we have a diverse group of stakeholders at the table, to discuss our vision, and craft the rule set?
- ✓ Did we write rules to control the uncontrollable, or did we write rules to align people to collaborative efforts aimed at achieving our goals together?
- ✓ Did we establish key feedback loops of communication and learning, to address emergent behaviors and consequences that may not conform to our intentions; and to help us drive ongoing sustained improvement as we learn from our experiences?

In these brief examples, we see some of the differences that a complexity perspective may bring to the work of change and improvement. The references and resources cited in this primer can help you learn more.

Next

"Learning is an option. Survival is an option."

— W. Edwards Deming

Throughout this primer we have journeyed to new knowledge and understanding. The complexity perspective reveals mutual relationships. As leaders of change, we begin to understand that we cannot control the patterns of thought and behavior in an organization the way we set out to control a manufacturing process on the shop floor. We do not stand apart from the systems or organizations we observe. Instead, we can articulate and share our vision with others and act together into the unknown future.

"What everyone knows is what has already happened or become obvious. What the aware individual knows is what has not yet taken shape, what has not yet occurred."

— T. Irene Sanders

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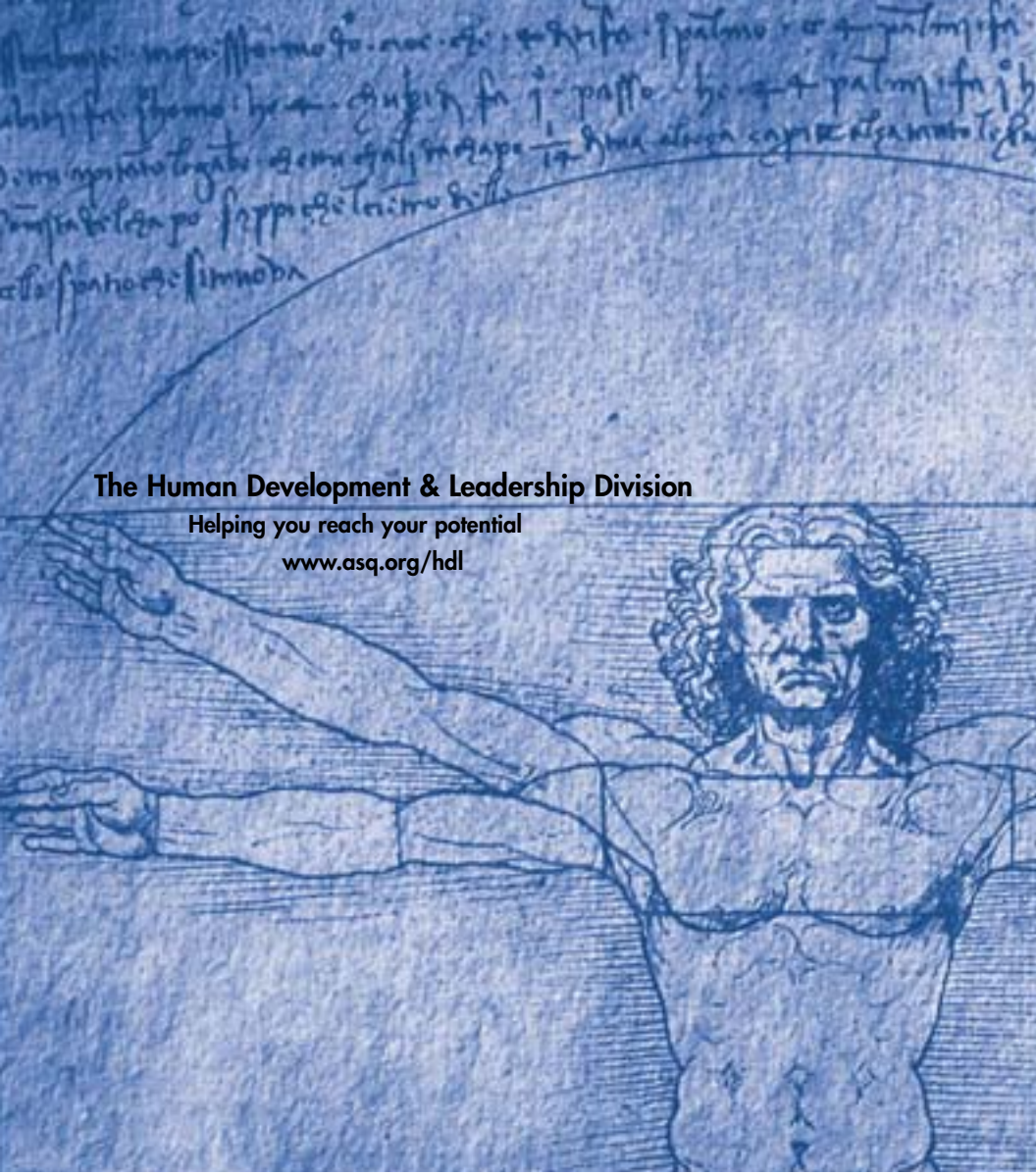

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