

Chapter 8

Fostering Creative Transformations in Organizations with Chaos

Robert Pryor

Australian Catholic University, Australia

Jim Bright

Australian Catholic University, Australia

ABSTRACT

This chapter introduces the Chaos Theory of Careers (Pryor & Bright, 2003b, 2011) as applied to organizational behavior. The authors argue that organizations and the people within them can be usefully thought of as complex dynamical open systems – or strange attractors. From this perspective, organizational behavior can be understood in chaos terms such as attractors, fractal patterns, non-linearity, emergence, and phase shifts. Understanding organizations in dynamic terms provides a coherent picture of the inherent uncertainty and change that organizations face. This, in turn, has implications for management models that need to move from command, control, and predict, to facilitation and disruption of closed system processes. The difference between organizational anarchy and a principled chaos-based approach are highlighted. A model of organizational and personal creativity is presented and linked to concepts such as fractal behavior, career development and the re-thinking of traditional goal-centered approaches to management and change. For organizations to thrive in a world that is inevitably complex, uncertain, and changing, the authors argue that the Chaos Theory of Careers provides a coherent management framework and suggests approaches that will foster the development of a creative and flexible organization to meet these contemporary challenges.

INTRODUCTION

How can organizations function effectively in the twenty-first century world? Probably the most accurate answer that could be given to that question is: not the way they were structured and functioned

in the twentieth century. Fundamentally twentieth century organizations focused on stability. Change was typically perceived as an aberration in the pervasive condition of stability. Organizations were structured essentially to resist change and disruption. The traditional hierarchical structure of organizations was based on an inspirational or at

DOI: 10.4018/978-1-4666-2509-9.ch008

least effective leader with a leadership team, who “set the course” for the organization. The policy and implementation strategies were developed at higher levels and gradually filtered down the hierarchy to the production and/or service provision levels.

Of course changes occurred but typically they were perceived to be gradual over time so as avoid disturbing the essential stability of the organization as a whole. In this context there were various forces to inhibit or resist many types of change. These forces included organizational culture and tradition, managerial insecurity, worker intransigence, union power, technological conservatism, risk averse shareholder demands and community expectations of reliability, dependability and just generally feeling comfortable with some products, services, and companies.

Economic depression and two World Wars along with the threat of the Cold War, encouraged people in many parts of the Western World at least, seek a level of stability and security and a longing for a feeling of control. Organizations also often reflected these aspirations as well. However, as the century wore on and even more so, in this century, other potent influences have emerged which have subverted and often rendered obsolete most of these former aspirations. Increasingly the imperatives of globalization, technological advances and the sheer speed and extent of modern communication inter alia, now present to organizations new challenges for which there are no precedents. To quote but one of many examples, we now live in a world that at the time of writing, reportedly has 800 million people registered on Facebook, about 50% of which are daily users. Such a phenomenon was simply inconceivable even ten years ago since the original Facebook website was not even launched until February 2004.

To return to the original question: how can organizations thrive in an environment characterized by such unpredictability and uncertainty; continual and non-linear change across cultures,

time zones, languages and geographical location; with such challenges for risk and failure? Most attempts to deal with these issues are fragmentary, piecemeal, overly specific and lacking the capacity for integration. This new world in which we now work does not appear to fit with traditional models of organizations or their theoretical counterparts.

In this chapter it is proposed that chaos theory can provide a theoretical framework through which a coherent perspective of twenty first century organizational challenges can be understood and effectively met. Specifically the application of fractality to organizations will be adumbrated with respect to vision statements and the development of organizational culture. The limitations of goal setting will be outlined in light of non-linear dynamics of change and an approach to creative development and problem solving will be presented as a strategic way to address the challenges of the inherent properties of strange attractors.

THE CHAOS THEORY OF CAREERS

Pryor and Bright (2011a) provides a comprehensive presentation of the application of Chaos Theory to the working environment. Chaos theory is a scientific conceptualization of reality which emphasizes the complex, interactive and interconnected nature of our world. While recognizing the individual constituents of reality (existents) chaos theory also draws attention to the holistic features of our world. Pryor and Bright (2003a, 2003b) conceptualized these as complex dynamical systems. Such systems are complex in the sense that there may be many influences both within them and impinging upon them. Such systems are dynamical because their complexity renders precise predictability of outcomes impossible and because the nature of the changes within the system are often non-linear (that is, the effects of change can be very disproportionate to the original cause of the change). This is popularly known as “the Butterfly Effect” (Lorenz 1993). The emphasis on

systems draws attention to the interaction between constituents that make up the whole. In fact, in chaos terms everything ultimately is linked to everything else (Barrabasi 2003).

Complex dynamical systems have four major characteristics:

1. **Aperiodicity:** Complex dynamical systems function in identifiably similar patterns but these patterns do not exactly repeat one another. The result is a characteristic stability to the system and yet at the same time there are changes which under certain conditions have the potential to totally transform the pattern of functioning of the system. This is called a “phase shift.”
2. **Bounds:** For systems to be identifiable as systems, they must have limits within which they function. It is the boundaries of systems which allow them to be recognized as specific distinct wholes. Chaos theory is not about total randomness and disorder, which would be the situation if systems were conceived as having no boundaries. Chaos theory addresses the way in which influences of stability and change interact within the confines of the constituents of the systems and which give the system its essential identity.
3. **Causality:** Chaotic systems are deterministic in the sense that their formation and functioning are dependent on preceding necessary and sufficient conditions. However, although deterministic such systems are not completely predictable; one legacy of complexity is that it is impossible to trace either backwards or forwards with precision the causal chain.
4. **Sensitivity to change:** Chaotic systems as a result of their complexity and interconnectedness are susceptible to change in their initial conditions. Since they are aperiodic in one sense, change is inherent in the way these systems function. For example, the human

heart beats in a generally regular rhythm but the beats are never exactly the same. Briggs and Peat (1989) note “Disruption in the normal fractal scaling of the heart’s time can cause pathology in two directions. If the heartbeat and respiration become highly periodic (regular), they can lead to congestive heart failure. On the other hand, a rhythm that is too aperiodic causes the defibrillation of a heart attack. Thus the normal ‘time’ of the heart oscillates in the borderland between order and chaos.” (pp. 107-108)

Attractors

As complex dynamical systems can be identified by characteristic patterns, for example, the weather can be represented as climatic patterns or individuals’ activity preferences by vocational interest profiles (Pryor & Bright, 2007). The characteristic way in which a system operates is called that system’s “attractor” (Williams, 1997). An attractor is an influence or set of influences which cause the system to function in a particular fashion. For example, the organizational climate of the now-defunct energy company ENRON initiated by its CEO Jeffrey Skilling was based on an “only the fittest employees survive” model (McLean & Elkind, 2004). In such a climate competing against other employees, assuming the credit for success, deflecting the blame for failure and “protecting your back at all times,” are likely to be some of the factors influencing the system of human communication in the company. Presumably the goal of retaining employment within ENRON was something like “thrive to survive.” Such a goal can be understood in Chaos Theory terms as a “point attractor” (see below). Such an attractor could be understood as the characteristic trajectory of the company’s employees being to make profits and progress in influence and power within the organization. The feedback mechanisms with such an attractor are likely to be to succeed quickly and to impress or you will no longer

work for the company. The end states of such an attractor are likely to be higher pay and benefits for work valued by the company and greater acknowledgement by management of performance or warnings, threats, pressure and dismissal for perceived failure. Chaos theory proponents have typically delineated four characteristic attractors.

Point Attractor

This attractor is operative when a system seeks to function to achieve a single end state or goal. Examples include a river flowing to the sea, a plane flying to a destination or an athlete seeking Olympic gold. ENRON is an organizational example of organizational climate as a point attractor. Organizations functioning as point attractors will stress deadlines, objectives, sales targets, incentives and production output levels. Setting and achieving goals become the major if not the sole criteria by which organizational success is evaluated. While such an approach can be effective in the short-term it is subject to a number of potential problems. In a business environment subject to non-linear change, setting long-term goals is unlikely to be effective, since by the time the “long term” arrives it is likely to be so different from what was originally envisaged it would be, that the goals achieved are likely at best to be irrelevant or at worst detrimental to the organization. The authors have worked with organizations which produced long-term specific vision and goal statements which were repeatedly subsequently superseded by new managers long before the visions or goals were realized. Typically the principal results of this process were wastage of resources and frustration for the staff.

A further limitation of point attractor thinking by management in terms of specific goal setting is that it may encourage myopic inflexibility in the form of single-minded focus on a specific outcome rendering the organization insensitive to other creative opportunities. This is discussed in more detail later in this chapter.

Pendulum Attractor

Just as a pendulum swings one way under the influence of one force and then back again in response to a competing force, this pattern can be characteristic of a variety of systems. In psychological terms it is typical of approach-avoidance conflict. Sociologically it is typical of the so-called “work-life conflict.” It is frequently in evidence in role conflicts and divided loyalties. In organizational terms a pendulum attractor could be apparent in managerial decision making about whether “to stick to our core business” or diversify the service or product range in ways in which the organizational has never previously ventured. Thus the need for change may press for diversification to broaden the company’s stream of income. However, the costs and risk of trying to do new things may itself threaten the longer term viability of the company. Such managerial vacillation may result in wastage of resources, missed opportunities and employee confusion.

Essentially the limitation of pendulum attractor thinking is the tendency to conceptualize problems or challenges in dichotomous terms, as though in most situations presented to management can only have one or other of two diametrically opposed solutions. Such thinking fails to consider ways to combine alternatives, seek further options, undertake limited trials of alternatives, reconcile competing demands or develop compromise (“middle of the road”) strategies. Pendulum attractor thinking often represents an inability to think creatively about new and uncertain situations. Hence the emphasis in this chapter on approaches for organizational management such as Beyond Corporate Mastery outlined below.

Torus Attractor

This attractor pattern is often characteristic of traditional approaches to organizational structures and functions. In order to deal with a multiplicity of actual or potential influences and challenges,

torus attractor thinking set up clearly defined structures to perform all the requisite functions – sales, production, marketing, human resources, finance and so on. The organization is intended to function like an efficient machine, with each department and each section within each department all contributing cohesively to deal with the complexity of influences and tasks that the organization has to confront in order to make a profit to ensure its survival. The attempt is to sustain control through procedures efficiently followed to the letter of the law.

Managers thinking in torus attractor terms typically place too much confidence in established procedures and systems. As a result when confronted with uncertain challenges or problems they tend to respond by trying rigidly to respond by fitting the situation into an already established response pattern. This encourages “silo” thinking and funding. It may result in demarcation disputes between the various departments within the organization. It can also create a mentality based on providing a service or manufacturing a product and seeing if anyone wants either, rather than starting from identifying a need and seeking to fulfill it.

Closed Systems Thinking

All three attractors outlined are essentially examples of “closed system thinking” (Pryor & Bright, 2011a). Closed systems thinking is characterized by expectations about the fundamental stability and predictability of systems and the belief that as a consequence change within systems can be foreseen and controlled. Thus, the point attractor thinking for individuals and companies, is typically characterized as focused on achieving specific goals such as providing some specific services or producing a particular set range of products. Change is perceived typically as something to be resisted, as a distraction to be overcome, so that the goal or business plan can be achieved.

In the pendulum attractor change is simplified to two competing influences and decision making

is conceived typically in either /or terms. Either we go with this change or we resist or seek to minimize its impact. It is typical of urgent and stressful situations and thus it illustrates the dichotomous thinking and ambivalent indecision of those caught in such situation.

When change is confronted by torus thinkers, the immediate response is to try to pigeon-hole it within existing structures. The thinking is that because the system is so well-organized all conceivable change must be able to be accommodated somewhere already within the system. There must be a policy relating to each new change and an appropriate section or department to implement the policy efficaciously.

However, it is increasingly evident that no matter how committed we may be to our goals, how much we try to dichotomies our options or how well organized we endeavor to be, the complex non-linear continuous and emergent changes that confront twenty-first century organizations will confound such (closed system thinking efforts (Taleb, 2007). The fundamental problems of closed thinking attractor thinking is that real world systems are not closed. That is, although real world systems are bounded, their boundaries are invariably permeable, that is, able to be impacted by other systems at any time. Systems theorists (e.g. Richmond, 2000) often call this “recursiveness” – that is, all systems can influence and be influenced by many other systems. In essence, this makes our attempts to be able to both anticipate and control many types of change virtually impossible. Despite our best closed system attractor thinking, the limits to our knowledge and power inevitably mean that we have to confront uncertainty.

Strange Attractor

The strange attractor (Bright & Pryor, 2005; Pryor & Bright, 2007) is an open system that has the seemingly paradoxical characteristics of being simultaneously self-similar and stable and yet

continually changing with the potential for radical transformation. A strange attractor can be thought of by considering these two hypothetical campus universities found in the imaginary countries proposed by Taleb (2007) of Mediocristan and Extremistan.

The University of Mediocristan is a campus university with a difference. On National Mediocrity Day 1st April, the Vice Chancellor celebrated by issuing an order to close all of the entrances to the University so that nobody could come in or go out. Furthermore, all current internet connections were cached and closed, so that the only information available on internet was whatever existed on that auspicious day. Telephones including mobiles were programmed to only allow internal calls. The mail room was shut down. Inter-library loans were stopped, and satellite dishes, television aerials, broadcasting and receiving systems were all shut down. Thus over the years, the University's fine reputation for innovation was lost, and eventually, the University went out of business once the last student died of old age.

Over in Extremistan, the Vice Chancellor identified several core values that characterized his University, they were: continual inquiry, education, equality and social justice. The Vice Chancellor and her team devised new forms of entry, invested in distance learning, offered scholarships to the needy and hugely increased the speed and number of communications systems to the help the University communicate with the outside world. Over time, the University changed, sometimes suddenly and dramatically, as new students came in and others left. Some disciplines flourished with amazing research breakthroughs and others with the popularity of their courses. Some hitherto popular courses ceased to exist as disciplines merged, de-merged, and new ways of thinking and exploring the world changed things. Indeed even the campus moved – and became a world-community campus with the Vice Chancellor working out of a Lincoln Smart Town Car and

a Space Station. Yet, over time, in every aspect of research, teaching, self-learning and community engagement, a pattern of continual inquiry, education, equality and social justice could be identified.

Thus the strange attractor is a dynamical open system, whose stability comes from continual change. When the potential for change is all but eliminated from the system by making it a complex torus attractor, like the Mediocristan example, the result is ironically short-term predictability and control, but gained at the expense of longer-term vulnerability.

It should be clear from those examples that healthy organizations, whether they like it or not, are strange attractors – that is, they need to be open systems in order to achieve longer-term stability and continuity. This somewhat obvious fact, flies in the face of most modern management approaches that are usually designed to close systems down in an attempt to make them more orderly and predictable.

However it would be a mistake as a consequence, to argue for some form of organizational anarchy as a preferred approach to managing a business. Such entreaties which from time to time are presented as the logical conclusion of applying chaos theory to organizations, overly privilege the power of self-organizing systems to create order, without sufficient consideration of the fact that chaotic systems work by having underlying rules or principles that govern the interaction of their elements. The self-organizing features of chaotic systems do not magically emerge from a chaotic mess, indeed dynamic order only emerges at specific times under narrowly defined terms hence the need for boundaries for such systems.

Consequently it is the role of managers to act as enablers to encourage the development of effective self-organizing systems. This is not synonymous with a “free for all” in which anything goes and anything is done. Rather it generally arises from the rigorous and fearless application of a coherent and consistent small set of principles. However

most organizations, in their anxiety to tame unpredictability and to manage complexity tend to fall into the trap of trying to over-specify and over-control, or micro-manage organizations. Too often in organizations uncreative management can be observed in the over-use and over-specification of rules. Generally this is due to a lack of a coherent vision, a lack of courage, a lack of trust in colleagues and a reactive approach to management. The result can be injurious to the culture of the organization and may result in the diminishment of decision-making discretion at all levels which has been clearly established to be a causal factor in occupational stress (e.g. Karasek, 1979, Jones & Bright, 2001).

The overuse and over-specification of rules is an attempt to control by transforming naturally open systems into closed systems, or in Attractor terms, an attempt to impose a Torus attractor on workplace behavior. The iterative application of a small number of principles is how chaotic systems develop, and it is what contributes to emergent order (Morowitz, 2002). It also provides inherent flexibility because nothing is over-specified or too narrowly defined. This allows for innovation, unexpected outcomes, consistency, and creativity. It also makes the system more resilient to those unexpected outcomes.

The operation of the iterative application of core principles can be graphically mapped in Fractals. These patterns are helpful in analyzing and understanding organizations and employees within organizations.

Fractals

The mathematical equations that generate chaotic patterns of the strange attractor can be plotted over time. It turns out that the patterns generated by strange attractors belong to a group of patterns that were first seriously researched by Mandelbrot (e.g. Mandelbrot, 1975, 1982) who denoted them as “fractals” which is used to describe patterns

that are self-similar across scale. Self-similarity across scale refers to the repeating pattern of similarity (technically symmetry) observed as one progressively magnifies or moves away from the pattern. The term fractal denotes the peculiar dimensionality of these patterns that falls between the one dimension of a line and the two dimensions of a plane. Fractal patterns are a powerful way to understand the workings of a chaotic system because they represent the emergent dynamic order of the system (Briggs & Peat, 1999).

The repeating pattern at every level within a fractal is a concept that can be easily mapped on to an organization or the production of a product or service. For instance at Apple, although they do not have a formal mission statement, CEO Tim Cook provided the following principles during an Investors Quarterly Conference call in January 2009, “We’re constantly focusing on innovating. We believe in the simple, not the complex. We believe we need to own and control the primary technologies behind the products that we make and participate only in markets where we can make a significant contribution. We believe in saying no to thousands of projects so that we can focus on the few that are meaningful to us. We believe in deep collaboration and cross-pollination in order to innovate in a way others cannot. We don’t settle for anything other than excellence in any group in the company, and we have the self-honesty to admit when we’re wrong and the courage to change. Regardless of who is in what job, those values are so embedded in this company that Apple will do extremely well.” (Cook, 2009).

This set of values have been fearlessly implemented by Apple, and by the co-founder, the late Steve Jobs consistently throughout Apple’s existence (Isaacson, 2001). Evidence of their operation can be found within all Apple’s activities. Most organizations have some form of values statements, leadership models, mission statements or similar that can be tied directly in to managing behaviours at every level and division from the

Board to individuals. The following is an example of how one of the authors used this approach to design career development interventions in a large bank in Australia.

THE CHAOS THEORY OF CAREERS (CTC) IN ACTION: A CASE STUDY USING OF HOW CTC CAN BE APPLIED IN ORGANIZATIONS

Successful managers and organizations need to be both focused and flexible in their behavior (Gelatt, 1989) if they are to handle the unpredictability and uncertainty inherent in a complex and changing environment. Market conditions change continuously and sometimes unexpectedly and dramatically. It follows that managers who are able to respond positively to change, or preferably take a proactive approach to change will create greater success than less flexible managers.

Flexibility alone is not sufficient for success and must be harnessed to a focused attitude. Flexibility without focus can lead to:

- Inconsistent and contradictory behavior;
- Whim-based and impulsive behavior;
- Employee confusion and role ambiguity;
- Communication breakdowns; and
- Failure to consolidate changes.

Focus alone is also not sufficient for success and must be harnessed to a flexible attitude. Focus without flexibility can lead to:

- Stubbornness and rigidity;
- Ego-driven behavior;
- Failure to spot or capitalize on emerging opportunities; and
- Failure to understand the bigger picture or the impact of actions on outcomes.

Traditional career development models characterize focus and flexibility as psychological traits

that are at opposite ends of a continuum. This means that managers are typically characterized as one or the other. The implication is that after assessment, the manager would be best suited to working in an area that prized focus or one that prized flexibility. Stereotypically opposite work environments for example might be actuarial work (focused) and marketing (flexible).

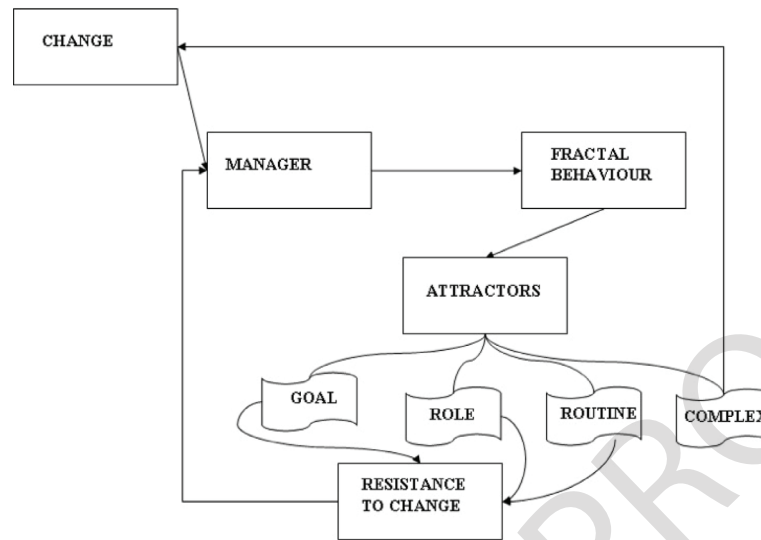
However modern working environments being strange attractors, are much more complex, dynamic and rapidly changing, and cannot be simplistically divided up into two categories. Such thinking is a reversion to pendulum attractor thinking. Both flexibility and focus are required by all managers, and especially in more senior roles.

Figure 1 illustrates the process. The figure shows a system where a manager is exposed to change influences. The manager's response to the change influence can be predicted from their Fractal Behavior—that is from the repeating pattern of behavior observed over time. The manager's behavior is likely to be dominated by one of the four attractors. If the manager tends toward Point (Goal), Pendulum (Role) or Torus (Routine) Attractors, they will be less open to change if it challenges their established pattern of behaving and may act to resist that change. If the manager's behavior is dominated by the Strange (Complex) Attractor they are more likely to embrace the change or act proactively to harness the change to create new opportunities.

The Chaos Theory of Careers (CTC) Career Development Model states that:

- People are complex and continuously changing.
- Work is complex and continuously changing.
- People display characteristic core patterns of behavior repeatedly over time and situations.
- These patterns are relatively stable but subject to minor modification over time and situations.

Figure 1. The CTC career development model in organizations



- Work demands particular core behavioral patterns across time and situations.
- These demands are relatively stable but subject to minor modification over time and situations.

The idea of “Organizational DNA” – the repeating pattern that exists in every aspect of operations - is broadly similar, but it does not convey sufficiently the existence of change that is present in all operations. DNA+Change is a closer analogy to the proposed model. “All organizations are fractal. I can’t think of any organization that isn’t deeply patterned with self-similar behaviors evident everywhere” (Wheatley, 1991, p.128).

In this framework Fractal Career Behavior refers to characteristic repeating patterns that are evident at every level of behavior and at every stage in a person’s career. Successful organizations display Fractal Values Behavior (FVB) – there should be a clearly discernible repeating pattern of each of the values across time and situations, which illustrates a positive responsiveness to complexity and its implications. Career Conversations provide an excellent opportunity to identify the extent of FVB by using specific cues to elicit the pattern.

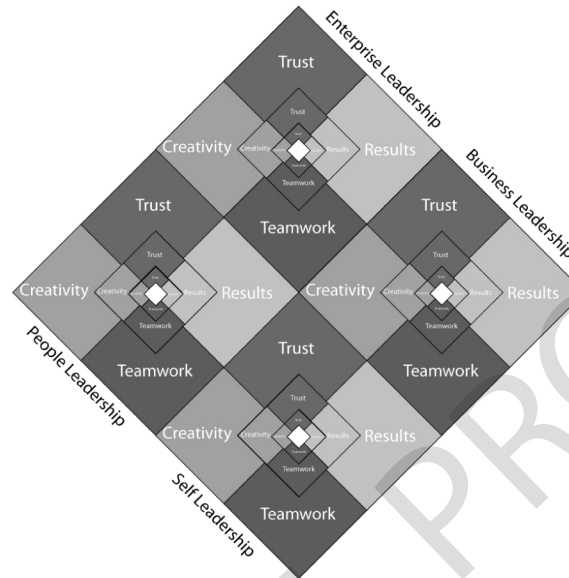
Figure 2 illustrates Fractal Career Behavior of organizational leadership dimensions of people, enterprise, business and self, through the application of the Chaos Theory of Careers.

Career Conversations provide an excellent opportunity to identify the extent of FVB by using specific cues to elicit the pattern. The Career Conversation method focuses on the Fractal Career Behavior part of the process, because this is the best predictor of future behavior and leadership potential in a complex and uncertain business environment. A series of “career probes” can be developed to assist in identifying the Fractal Values Behavior. These are deliberately based upon the values model because employees who are not aligned with these values are unlikely to succeed within the organization. In addition to the organization’s values, other probes are provided that explicitly address:

- Flexibility (e.g. “What characteristics of team members are best able to respond to change?”)
- Persistence (e.g. “What indicators would you use to relinquish continuing to sell a product?”)

Fostering Creative Transformations in Organizations with Chaos

Figure 2. Fractal values behavior for organizational leadership (© Bright and Associates, all rights reserved)



- Strategy (e.g. “What could you do to improve the ethical standards of your organization?”)

These complement and reinforce the probes around the organizational values to provide a fuller picture of the manager’s behavior. The Career Conversation Process is a free-flowing conversation conducted with a manager. The career development specialist is provided with a set of specific cue questions that are designed to address the organization’s culture via its values but at the same time to assist the career development specialist to identify the dominant attractors being used by the manager. In this way the degree to which the individual is open to change and is flexible and focused can be ascertained across the various relevant organizational values.

Implementation of the Career Conversation Process technique is intended to lead to the following outcomes:

- Greater structure for the career conversations.

- Maintaining the flexible nature of the conversations.
- Clarity of purpose of career conversations.
- Identification of potential managers.
- Alignment of conversations with the organizational leadership model.
- Alignment of conversations with organizational values.
- Identification of issues arising for managers.
- Structured data that can be readily combined with other sources of information such as the 360 degree evaluations.
- Reinforcing organizational values.
- Reinforcing messages around flexibility, persistence and strategy.

Thus the Chaos Theory of Careers in this application impacted the organization at the level of the content of the fractal values that the organization needed to pursue in a complex changing interconnected world and at the same time directed the process of implementation through the application of the concepts of attractors and fractal behaviors.

THE CHAOS THEORY OF CAREERS AND ORGANIZATIONAL GOAL SETTING

Another dimension of organizational functioning to which the Chaos Theory of Careers brings a new perspective is that of goal setting. Goals and goal setting are often presented the keys to both personal and organizational success (e.g. Covey, 1989 & 2004). Most extant models of organizational change and career development depend to a greater or lesser extent upon goal setting to motivate change. However goal-setting carries with it the implicit assumption that there will be minimal change in either the environment (including the goal posts) or in the goal-setter beyond that change expected to occur as a result of setting the goal. Most often there is a demand that these goals must be explicitly and comprehensively specified at the time of setting them. It is frequently asserted that successful goals possess the qualities of being Specific Measurable, Achievable, Realistic and Time-based – the so-called SMART goals. Goals of this nature do not fit easily into the key premises of the CTC that rests upon change, chance and uncertainty.

It turns out that the necessary condition of goal setting that both the person and the environment are relatively unchanging, breaks down in real life settings. Tubbs (1986) examined 87 separate studies on goal setting, that showed a consistent pattern. Goal setting tended to be effective in closed and controlled environments like laboratories, but was far less effective in more open real-life situations such as those typically encountered by organizations. This is because unlike laboratories, real life is a more open system with the potential for large numbers of different influences to interact in unpredictable ways creating complexity and change. This is very consistent with what would have been predicted by the Chaos Theory of Careers since goals are examples of point attractor thinking which is most effective in closed systems.

The real life problem being that real life, including the business environment, is not a closed system.

The relationship between the predictable and the unpredictable, between pattern and surprise and between composition and improvisation that is observed in all forms of organizational behavior from career development, to teams, to organizational design is dynamic, complex and unpredictable in of itself (e.g. Borg, Bright & Pryor, 2006). Such conditions fall well short of the necessary stability required for effective goal setting.

A common response to this line of criticism of goal setting is that commitment to one's goals goes a long way to overcoming turbulence caused by naturally occurring change processes. Thus it is argued that for goals to be effective, the person or organization must truly want to achieve their goals. This raises the possibility that the effectiveness of goals in real life settings is attenuated due to a drop off in goal commitment over time. However, that does not seem to be the case. Donovan and Radosovich (1998) conducted an examination of goal commitment and performance across 12 studies over 20 years, involving 2000 participants, and found that goal commitment accounted for almost none of the performance variance. It seems that being committed to your goals may give you a feeling of purpose and direction, but may have little or no impact upon the outcome.

The process of feedback that is so central to complex systems may provide a method for re-interpreting and re-applying ideas derived from goal setting (Briggs & Peat, 1989). Feedback can encourage (accelerate or amplify) a process, or moderate (decelerate, diminish) a process. The timing and nature of the feedback can also be critical in terms of its impact on system functioning, where the same feedback delivered at different times can have completely opposite impacts. For instance highly critical feedback early in a cycle may stymie or completely stop a system, whereas later in the process the same feedback might be motivational or helpfully guiding.

If we understand the central role of feedback, then emphasis is moved away from a commitment to an objective and goal and focused more upon a commitment to attending to ongoing feedback. So instead of being committed to increasing share-holder dividends by 200%, which is an outcome focused approach it can be replaced by being committed to maximizing share-holder dividends at all times, a process oriented approach. In order for this to work, mechanisms must be in place that provide multiple forms of feedback capturing diverse aspects of the task. Further, this feedback must be considered appropriately and regularly to allow goals to be maintained, modified or abandoned. Feedback mechanisms need to be both positive and negative and they need to be both continuous and intermittent. Such a formulation provides CTC practitioners with a method and process that allows an emphasis on planning as much as on a plan, and helps to avoid being captured within an inflexible point attractor that is the side effect of adopting SMART goals.

Chaos and Organizational and Personal Creativity

The call for innovation and creativity in Western organizations is louder now than it has ever been. Some commentators argue that innovation is the main strategy to address the challenge of the globalization, automation and customer choice (e.g. Pink, 2005). While others argue that organizations should leverage their customers as innovators and provide government incentives for innovation (e.g. von Hippel, 2005).

From a CTC perspective, innovation is a rational response for organizations which are open dynamical systems operating within and between other similar systems. The management literature is filled with case studies illustrating the dire consequences for companies that have failed to innovate (Omerod, 2005). Generally work on creativity or innovation has tended to focus on the special qualities of particularly innovative

or creative people or organizations (e.g. Gelb & Caldicott, 2007; Burstein & Anderson, 2011) and inevitably some psychologists have looked for individual differences in creativity (e.g. Mumford 2003). Mumford (2003) reviews a range of different approaches to creativity, and argues that it is a dynamic and complex issue. However, we can start from a relatively contentious position, that creativity and innovation require memory.

Creativity involves making links between what we are currently thinking of and other experiences we have previously had. Creativity requires memory. This obvious point about creativity is largely overlooked in most treatments of the subject that favor considerations of psychological traits (e.g. Csikszentmihalyi, 1997) or the environments that promote creativity (e.g. Pink, 2005; Robinson, 2009). Focusing on characteristics and environments that promote creativity has resulted in a plethora of studies and stories that look at creative people and attempt to draw conclusions about their traits, ways or worlds. Like much of the self-improvement literature, the conclusions are limited by a failure to study the uncreative to see if they possess similar characteristics to the creative people or share similar environments.

Looking at the cognitive processes involved in creativity provides a different perspective that offers the promise of revealing processes that are involved in being creative. So understanding memory may provide a key to being creative.

Creativity Defined

Creativity is generally agreed to involve the production of something novel and worthwhile (e.g. Mumford, 2003). Since both novelty and value are socially determined judgments as Csikszentmihályi (1997) points out, we must look for memory processes that lead to ideas that may be contenders for the appellation of creativity, ideas in of themselves cannot be “creative.”

Creativity is also generally agreed to involve connecting existing ideas, things, or processes

Figure 3. The beyond corporate model® (© 2009, Bright and Associates, used with permission)



to create the novel and worthwhile thing. This is where memory plays a role, in the process of making the links between the new and the old, or even the old and the old. Our long term memory comprises billions of traces encoding all of this experience. When we come to recall something, we probe our memories to make the links between a current memory residing in working memory and a stored memory trace in long term memory.

If we use the current experience in working memory as a probe of our long term memory, we can bring to mind two things in consciousness at the same time and that allows us to make the link and then store a new memory that is the composite of the new experience and the old memory. The same mechanism explains the power of reflection in learning as it allows us to recall a previously stored memory and then use that to probe for other stored memories and then link those together in a new memory.

Essentially, this is the cognitive mechanism that underpins the Combining and Adding step in the Beyond Corporate Mastery® model of creativity see Figure 3.

The Beyond Corporate Mastery Model (Bright, 2009a, 2009b) comprises the Seven Action Steps and Mind Steps required for creativity. There are two fundamental and complementary ways of achieving change: taking action and changing mindsets and cultures. The seven action steps are:

Inspiration, Patterning, Learning, Emulating, Combining and Adding, Strategizing, and Doing. Further elaboration of these steps can be found in Pryor and Bright (2011a).

1. **Inspiration:** Inspiration here equates to taking in an experience. Creative organizations are continually open to new experiences and ideas. As many staff as possible should be given the opportunity to take in new experiences.
2. **Patterning:** As new experiences are gained, the structures, the hidden meanings, the ideas contained within them need to be identified.
3. **Learning:** In this stage, the patterns of the experience are analyzed and categorized into existing categories, or new categories are developed to accommodate the new information.
4. **Emulating:** Emulating or leveraging is the step where Organizations attempt to replicate, reproduce or accurately recall the experience. However, such a strategy is inherently limiting as it depends upon the innovation being done elsewhere and out of the control of the organization, which poses even further risks. Completion of this stage represents proof of mastery of an idea, process or product, but to remain competitive in a rapidly changing world, organizations

need to go beyond mastery (hence the title of the model) to become creative.

5. **Combining, Adding and Emerging:** This is the key critical stage, where a new experience or idea is linked back to a previous experience, and combined in a manner that creates something new or different. Typically organizations use brain-storming to achieve this linking process, however simply putting people in a room and expecting them to come up with something novel is a hard ask, and research shows that such activities can easily be derailed and dominated by verbally confident individuals which can stymie creativity. This underlines the importance of having a large repository of stored collective experience that has been reflected upon deeply, and categorized through learning for easy retrieval. The more of these experiences that are stored, the greater the chances of combining them in creative ways with new information. This is consistent with Duggan's (2007) notion of strategic intuition.
6. **Strategizing:** The next step in the process is to develop a strategy to make the combining and adding link a reality. The critical point here, is that strategizing comes after the solution is discovered by making the links. In this way it reflects Anygal's (1941) observation that the path one is already on determines what choices can be made; the goal does not set the direction, the direction determines what can be a goal. This formulation serves to keep organizations open to creative possibilities and leaving them free from committing to a course of action until the last possible time.
7. **Doing:** Implementation is the last stage of the model, and also the precursor to more Inspirations as experiences from the Implementation phase should be fed back into the Inspiration step. The Doing stage

is a critical one, if creativity is seen as producing something both novel and useful. This stage may represent only one cycle in a service, or product development, perhaps an early version, a 1.0 implementation or a prototype. Indeed the model described here captures the rapid-prototyping approach adopted by companies renowned for their innovative practices such as IDEO (Kelley, Littman & Peters (2001).

The Mind Steps represent the psychological, motivational and emotional factors that have been shown to foster innovation and creativity. The seven Mind steps that complement and support the Action steps are: Optimism, Openness, Self-Efficacy, Vision, Playfulness, Flexibility and Persistence.

1. **Optimism:** The recent resurgence of interest in Positive Psychology (e.g., Seligman, 1998, 2002; Gillham, 2000) highlights the importance of optimism in change programs. Equally, it seems highly unlikely that without a culture of optimism, organizations or individuals within it are likely to seek out the new inspirations, or bother patterning them, learning from them, reproducing them or combining them with other ideas.
2. **Openness:** Creative organizations are continually open to new ways of doing things and new ideas. This does not mean they are open with their corporate or commercial secrets. Nor does it mean the critical acceptance of any fad ideas or crazy schemes. Rather it is a stance of being prepared to investigate and explore rather than dismissing out of hand.
3. **Self-Efficacy:** This is a concept pioneered by psychologist Albert Bandura (1994), and relates to the belief that you can do something or achieve something. Developing a strong sense of corporate self-efficacy as well as personal self-efficacy will result in

the development of a can-do culture and more ready engagement in creativity and innovation.

4. **Vision:** Vision is the general sense of having a direction and purpose. It is often reflected in corporate values or vision statements. The description of Tim Cook of how Apple operates quoted earlier is a good example of a vision statement. This is the stage where the fundamental repeating principles that establish the powerful fractal patterns of the organization are developed.
5. **Playfulness and Risk:** The idea of stretching things to breaking point (failure) is used as a potent way of testing the true limits or potential of a product. Embracing risk in this way, is to embrace the idea of failing successfully (Pryor & Bright, 2011b). Equally, there is a growing awareness of the importance of play in learning (Cziksenti-mihalyi, 1997) which is related to the idea of trial and error – or failure as endeavor. The challenge is to process new experiences and re-process older ones without automatically categorizing them according to well-learned rules derived from experience. Rather things need to be looked at with new eyes.
6. **Flexibility:** In Organizations, flexibility is about valuing complexity since it provides opportunities to adopt varying perspectives and to try out new approaches. It also means creating structures within organizations which allow such thinking to occur.
7. **Persistence:** Not all problems are easy to solve with just a few actions or ideas. Not all attempted solutions work, in fact, most do not (Harford, 2011). Creativity with organizations involves the ongoing utilization of the Beyond Corporate Mastery principles. Strange attractors do exhibit stability and form but not indefinitely and not predictably. Modern organizations that stop being creative most commonly end up stopping altogether.

CONCLUSION

Omerod (2005) observed that, “stability, order and equilibrium continue to be emphasized when the real world is characterized by constant change, evolution and disequilibrium.” (p. ix). In chaos theory terms this reflects closed systems thinking, that our world and the organizations we set up in it, can be controlled and predicted if only our managers could set better goals, establish more clearly structured worker roles or organize the work more effectively. The aim is to “manage risk,” resist change and to continue to do “what we do best” and “what we have always done.”

However, any review of the history of organizations for the last 100 years, will clearly reveal that, “it is failure rather than success which is the distinguishing feature of corporate life.” (Omerod, 2005, p. 12). The single biggest benefit that chaos theory can bestow on organizational theory and behavior, is the recognition that complexity cannot be controlled, that uncertainty is intrinsic to reality and that failure is inevitable. However, this is not a “counsel of despair” but rather a clarion call to open systems thinking. In this chapter the authors have endeavored to illustrate three major ways in which such a call can be and, in some cases, is being answered. Thus it is when organizations recognize their fractality and the importance of the process of emergence within their structures and between their employees, that risk taking, creativity and quantum developmental leaps will become manifest. We also sought to illustrate the limitations of accepted notions about goal setting such as “commitment to goals.” Too much commitment is to lock in the point attractor mindset which overlooks, denies and resists change and opportunity. Attention was drawn to commitment to feedback and to process rather than to goals per se, which will produce more adaptation to change and greater utilization of new possibilities.

In addition in this chapter, a Beyond Corporate Mastery model was outlined, to exemplify the kinds of thinking and behavior processes that

a complex dynamical systems environment is likely to require, if organizations are to respond to contemporary business challenges with creativity.

There is further potential for the Chaos Theory of Careers (Pryor & Bright, 2011a) to contribute to the management of organizations in the twenty-first century including:

- The role of spirituality within organizations has been the focus of attention (Ashmon & Duchon, 2000; Covey, 2004; Conger, 1994). The emphasis in the CTC on meaning and purpose as fractal boundaries of attractors (Briggs & Peat, 1999) could be applied to the investigation how organizations might further infuse their work with meaning and purpose for all the relevant stakeholders;
- When systems align in some way their combined impact on other systems is designated resonance. As an example, Bright, Pryor, Chan, & Rijanto (2009) empirically investigated the concatenating effects of multiple chance events on individuals' career development using concepts derived from the CTC. Strogatz (2003) has also drawn attention to the synchronisation of systems within a chaos theory context. Complexity implies a multiplicity of influences at least some of which will be concurrent. This interactive influence impact on organizations within chaos theory frameworks remains a likely fruitful area for both theory and research;
- Pryor and Bright (2011b) applied CTC conceptualization to the issue of failure in individuals' career development. Similar application could be made to organizations. The strategic and the creative use of failure has been discussed by Harford (2011). He drew attention to the inevitability of failure, the need to accept it, the importance of multiple experimentation, the necessity to limit the impact of failure and the kinds of obstacles that result in a failure to learn from failures. The application of such issues to specific organizations across different industries presents stimulating possibilities for the application of CTC concepts such as *inter alia*, emergence, feedback commitment and creative problem solving through *Beyond Corporate Mastery*;
- Organizational adaptation and resilience in a strange attractor world is necessary for survival. From the CTC and Neault (2002) the concept of "luck readiness" was derived and subsequently assessed (Pryor & Bright, 2005). Further research into the Luck Readiness Index may assist in the identification and application of opportunity awareness development within organizations;
- Increasing globalization of business operations presents organizations with many new challenges in dealing with those from different cultures. The CTC emphasis on attractors and their fractals may be able to shed some light and suggest some additional strategies for meeting such challenges. Culture is an emergent quality from the interaction of strange attractors across geographic and ethnic groups (Holland, 1995 & 1998). It has properties of both stability and change – what these properties are and how they might be used or changed for business operation purposes, remain topics they are likely to exercise the minds of managers and executives in a globalized market.

Our world and the organizational contexts within it, are characterized by complexity, change, interconnection, uncertainty, unpredictability and failure (Stacey, Griffen & Shaw, 2000). They can be viewed as forbidding and hostile environments in which risk must be avoided, failure eschewed

and control asserted. However, such thinking not only limits success but will, as the history of organizations' survival has shown, ultimately ensure the very outcomes it is designed to avert. However, if organizations will embrace the chaotic nature of reality then such perceived threats may become opportunities to discover new products and services which can benefit us all.

REFERENCES

- Anygal, A. (1941). *Foundations for a science of personality*. New York, NY: The Commonwealth Fund.
- Ashmos, B. E., & Duchon, D. (2000). Spirituality at work. *Journal of Management Inquiry*, 9, 134–145. doi:10.1177/105649260092008
- Bandura, A. (1994). Self-efficacy. In Ramachandran, V. S. (Ed.), *Encyclopedia of human behavior (Vol. 4, pp. 71–81)*. New York, NY: Academic Press.
- Barabasi, A.-L. (2003). *Linked: How everything is connected to everything else and what it means for business, science, and everyday life*. New York, NY: Penguin.
- Borg, T., Bright, J. E. H., & Pryor, R. G. L. (2006). The butterfly model of careers: Illustrating how planning and chance can be integrated in the careers of secondary school students. *Australian Journal of Career Development*, 15(3), 54–59.
- Briggs, J., & Peat, F. D. (1989). *Turbulent mirror: An illustrated guide to chaos theory and the science of wholeness*. Grand Rapids, MI: Harper & Row.
- Briggs, J., & Peat, F. D. (1999). *Seven lessons of chaos: Spiritual wisdom from the science of change*. New York, NY: Harper Collins.
- Bright, J. E. H. (2009a). *Beyond personal mastery*®. Retrieved 1 January, 2010, from www.beyondpersonalmastery.com
- Bright, J. E. H. (2009b). *Beyond corporate mastery*®. Retrieved 1 January, 2010, from www.beyondcorporatemastery.com
- Bright, J. E. H., & Pryor, R. G. L. (2005). The chaos theory of careers: A user's guide. *The Career Development Quarterly*, 53(4), 291–305. doi:10.1002/j.2161-0045.2005.tb00660.x
- Bright, J. E. H., Pryor, R. G. L., Chan, E., & Rijanto, J. (2009). The dimensions of chance career episodes. *Journal of Vocational Behavior*, 75(1), 14–25. doi:10.1016/j.jvb.2009.02.007
- Burstein, J., & Andersen, K. (2011). *Spark: How creativity works*. New York, NY: Harper.
- Conger, J.A. (1994). *Spirit at work*. San Francisco, CA: Jossey-Bass.
- Cook, T. (2009). Top of Form *Bottom of Form* Apple Inc. *F1Q09 (Qtr End 12/27/08) earnings call transcript*. Retrieved January 13, 2012, from <http://seekingalpha.com/article/115797-apple-inc-f1q09-qtr-end-12-27-08-earnings-call-transcript?part=qanda>
- Covey, S. R. (1989). *The seven habits of highly effective people: Restoring the character ethic*. Melbourne, Australia: The Business Library.
- Covey, S. R. (2004). *The 8th habit: From effectiveness to greatness*. New York, NY: Free Press.
- Csikszentmihalyi, M. (1997). *Creativity: Flow and the psychology of discovery and invention*. New York, NY: Harper Perennial.
- Donovan, J. J., & Radosovich, D. J. (1998). The moderating role of goal commitment on the goal difficulty-performance relationship: A meta-analytic review and critical reanalysis. *The Journal of Applied Psychology*, 83, 308–315. doi:10.1037/0021-9010.83.2.308
- Duggan, W. (2007). *Strategic Intuition: the creative spark in human achievement*. New York, NY: Columbia University Press.

- Gelatt, H. B. (1989). Positive uncertainty: A new decision making framework for counseling. *Journal of Counseling Psychology, 36*, 252–256. doi:10.1037/0022-0167.36.2.252
- Gelb, M., & Caldicott, S. M. (2007). *Innovate like Edison: The success system of America's greatest inventor*. New York, NY: Dutton.
- Gillham, J. E. (Ed.). (2000). *The science of optimism and hope: Research essays in honor of Martin E. P. Seligman*. Radnor, PA: Templeton Foundation Press.
- Harford, T. (2011). *Adapt: Why success always starts with failure*. New York, NY: Farrar, Straus and Giroux.
- Holland, J. H. (1995). *Hidden order: How adaptation builds complexity*. Cambridge, MA: Perseus Books.
- Holland, J. H. (1998). *Emergence: From chaos to order*. Reading, MA: Addison-Wesley.
- Isaacson, W. (2011). *Steve Jobs*. New York, NY: Simon & Schuster.
- Jones, F., & Bright, J. E. H. (2001). *Stress: Myth, theory and research*. London, UK: Prentice Hall.
- Karasek, R. A. (1979). Job demands, job decision latitude and mental strain: Implications for job redesign. *Administrative Science Quarterly, 24*, 285–307. doi:10.2307/2392498
- Kelley, T., Littman, J., & Peters, T. (2001). *The art of innovation: Lessons in creativity from IDEO, America's leading design firm*. New York, NY: Doubleday.
- Lorenz, E. (1993). *The essence of chaos*. Seattle, WA: University of Washington Press. doi:10.4324/9780203214589
- Mandelbrot, B. (1975). *Les objets fractals: Forme, hazard et dimension*. Paris, France: Flammarion.
- Mandelbrot, B. (1982). *The fractal nature of geometry*. San Francisco, CA: W.H. Freeman and Company.
- McLean, B., & Elkind, P. (2004). *The smartest guys in the room: The amazing rise and scandalous fall of Enron*. New York, NY: Portfolio (Penguin Group).
- Morowitz, H. J. (2002). *The emergence of everything: How the world became complex*. New York, NY: Oxford University Press.
- Mumford, M. (2003). Where have we been, where are we going? Taking stock in creativity research. *Creativity Research Journal, 15*(2 & 3), 107–120.
- Neault, R. A. (2002). Thriving in the new millennium: Career management in the changing world of work. *Canadian Journal of Career Development, 1*(1), 11–22.
- Ormerod, P. (2005). *Why most things fail: Evolution, extinction and economics*. Hoboken, NJ: John Wiley.
- Pink, D. (2005). *A whole new mind*. Sydney, Australia: Allen & Unwin.
- Pryor, R. G. L., & Bright, J. E. H. (2003a). The chaos theory of careers. *Australian Journal of Career Development, 12*(2), 12–20.
- Pryor, R. G. L., & Bright, J. E. H. (2003b). Order and chaos: A twenty-first century formulation of careers. *Australian Journal of Psychology, 55*(2), 121–128. doi:10.1080/00049530412331312984
- Pryor, R. G. L., & Bright, J. E. H. (2004). “I had seen order and chaos but had thought they were different.” Challenges of the chaos theory for career development. *Australian Journal of Career Development, 13*(3), 18–22.
- Pryor, R. G. L., & Bright, J. E. H. (2005). *Luck readiness index*. Sydney, Australia: Congruence.

Pryor, R. G. L., & Bright, J. E. H. (2007). Applying chaos theory to careers: Attraction and attractors. *Journal of Vocational Behavior*, 71(3), 375–400. doi:10.1016/j.jvb.2007.05.002

Pryor, R. G. L., & Bright, J. E. H. (2011a). *The chaos theory of careers: A new perspective on working in the twenty-first century*. New York, NY: Routledge.

Pryor, R. G. L., & Bright, J. E. H. (2011b). The value of failing in career development: A chaos perspective. *International Journal for Educational and Vocational Guidance*, 11(3).

Richmond, B. (2000). *The “thinking” in systems thinking: Seven essential skills*. Williston, VT: Pegasus.

Robinson, K. (with Aronica, L.). (2009). *The element. How finding your passion changes everything*. New York, NY: Viking Books.

Seligman, M. E. P. (1998). *Learned optimism*. New York, NY: Pocket Books (Simon and Schuster).

Seligman, M. E. P. (2002). *Authentic happiness: Using the new positive psychology to realize your potential for lasting fulfilment*. New York, NY: Free Press.

Stacey, R., Griffen, D., & Shaw, P. (2000). *Complexity and management: Fad or radical challenge to systems thinking?* London, UK: Routledge.

Strogatz, S. H. (2003). *Sync: The emerging science of spontaneous order*. New York, NY: Hyperion. doi:10.1063/1.1784276

Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. New York, NY: Random House.

Tubbs, M. (1986). Goal setting: A meta-analytic examination of the empirical evidence. *The Journal of Applied Psychology*, 71(3), 474–483. doi:10.1037/0021-9010.71.3.474

von Hippel, E. (2005). *Democratizing innovation*. Cambridge, MA: MIT Press.

Wheatley, M. (1991). *Leadership and the new science* (2nd ed.). San Francisco, CA: Berrett-Koehler.

Williams, G. (1997). *Chaos theory tamed*. Washington, DC: Joseph Henry Press/National Academy Press.

KEY TERMS AND DEFINITIONS

Beyond Personal Mastery®: A process model of personal and organizational creativity based on seven mind and action steps.

Dynamical System: A system that is continually moving, and cannot be completely described or predicted. Rather general statements about its path, stability and motion can be made.

Emergence: The self-organisation of a system into an identifiable and relatively stable pattern.

Fractal: The pattern created when plotting out the trajectory of a Strange Attractor. Displays characteristic symmetry over scale – i.e. repeating self-similar patterns at every level of magnification.

Non Linearity: The potential for small changes in initial system conditions to have disproportionately large effects on subsequent system behavior, or the corollary that large changes may have a disproportionately small effect on subsequent system behavior.

Pendulum Attractor: Limits a system to move between two defined and fixed points (much like the pendulum of a clock).

Phase Shift: The reconfiguration of a system into a new way of operating – e.g. water molecules transforming from water to ice, or water to steam.

Point Attractor: Constrains behavior of a system to move toward or through a fixed point.

Strange Attractor: Limits a system to move through an infinite number of points without repetition, but with self-similarity, and susceptible to sudden and dramatic alterations in the trajectories and shapes of the system.

Torus Attractor: Limits a system to repeatedly cycle through a range of fixed points, for instance wrapping wire around a donut.

IGI GLOBAL PROOF