Articles

Complexity, Chaos, and Nonlinear Dynamics: A New Perspective on Career Development Theory

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The author presents a theory of career development drawing on nonlinear dynamics and chaos and complexity theories. Career is presented as a complex adaptive entity, a fractal of the human entity. Characteristics of complex adaptive entities, including (a) *autopiesis*, or self regeneration; (b) open exchange; (c) participation in networks; (d) fractals; (e) phase transitions between order and chaos; (f) search for fitness peaks; (g) nonlinear dynamics; (h) sensitive dependence; (i) attractors that limit growth; (j) the role of strange attractors in emergence; and (k) spirituality, are described and then applied to careers. The article concludes with a brief case analysis and implications for practice and research.

The human experience of work varies from joy to desperation, from the excitement of the new to the boredom of "been there, done that." For example, one would not expect a successful American actor at the height of his powers to say, "I felt desolate, disinterested in my work. How did this happen to me?" Yet, at age 55, this is just what Richard Dreyfus said of himself (Weinraub, 2001). In contrast, at age 70, Roget doctor, explorer, inventor, and writer—on his retirement began work on his plan for something unseen before. That something was to become the familiar *Roget's Thesaurus*. Jung (1933) aptly described Dreyfus's dilemma in *Modern Man in Search of a Soul*. In it, he described what he called "the general neurosis of our time." "About a third of my cases," he wrote, "are suffering from no clinically definable neurosis, but from the senselessness and emptiness of their lives" (p. 61). He continued,

> It is difficult to treat patients of this particular kind by rational methods, because they are in the main socially, well adapted individuals of considerable ability, to whom normalization means nothing. . . . The ordinary expression for this situation is: "I am stuck." (Jung, 1933, p. 61)

Again in contrast, the poet Donald Hall (1993) described his feelings about work in "the best part of the best day," as one in which *"absorbedness* occupies me from footsole to skulltop" (p. 41).

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Career counselors have taken as their mission to move people from being "stuck" to finding the work that leads them to "absorbedness" and, even more broadly, to work with people at every stage of life—youth to adulthood, middle age to elder status—so that all may achieve a sense of purpose and meaning in the work they do. To accomplish this mission, career professionals have developed theories and theory-based methodologies and tools.

The predominant career theories, what might be called "classic career development," have been based primarily on the reductionist paradigms of science prevalent in all fields throughout the 19th and most of the 20th centuries. Reductionist approaches rely on an underlying understanding that finding and isolating all the parts will lead to the total or sum of knowledge about a phenomenon or organism, yielding reliable predictions and replicable interventions. This is the basis of what has been called the scientific method. The focus is on identifying structures and processes. Reductionist science has yielded many of the great discoveries that enrich contemporary life, from antibiotics that increase life expectancy to communications that appear to decrease distances around the globe. The same is true in career development. The two theoreticians whose work exemplifies the best of structure and process approaches are, respectively, Holland and Super. *The Career Development Quarterly* annual review for 2001 "indicates that Super and Holland continue to have a substantial influence on both research and practice in the field of career development and counseling" (Whiston & Brecheisen, 2002, p. 126). In addition, the authors of the review noted continued interest in the work of Parsons and in social cognitive career theory, two additional process theories.

However, in the late 20th century, many supposedly immutable truths were thrown into question not by those who simply questioned the truths but by those who had gone beyond doubting the individual beliefs to doubting the very system of thought in which the beliefs were constructed. The theory of relativity and subsequent discoveries in physics overturned the assumed limits of Newtonian or classic physics as certainly as Copernicus and Galileo overthrew the belief system of the ancients. Investigations into complex phenomena in both the physical and biological sciences have shown that an understanding of relationships, subsuming structure and function, is a more fruitful path to understanding all complex entities. These complex entities include not only all of life from single cells to human beings but also organizations from ant colonies to corporations. Because it is the nature of each entity to adapt to its environment and internal state to maintain its life, these entities may be dubbed *complex adaptive entities.* The theories that explain these entities fall under the rubrics of *chaos theory, complexity theory,* and *nonlinear dynamics,* the last being the more general term. Career development theorists and researchers have yet to explore these approaches in any detail. (A search of ERIC, all years; InfoTrac's One File, all years; PsycINFO; and ProQuest's ABI and Interdisciplinary Research Library, 1986–present for empirical research related to career and chaos, complexity, nonlinear, nonlinear dynamics yielded a total of two reports.) The career development theory presented in this article focuses on relationship and nonlinear dynamics. It is the theory of career as a complex adaptive entity, a theory that enables career

practitioners to understand and explain what otherwise appears to be the messiness of life, a theory that reveals the underlying order in what otherwise appears to be random.

It should be noted that Savickas (Savickas & Lent, 1994) has been seeking convergence in career development theories since at least 1994. Subsequent to the initial development of this article, I read Savickas's (2001) outstanding piece that summarized the major career development theories and suggested a new approach to a unified theory of career development. His approach provided support for the idea that I have advanced: career as a complex adaptive entity. Savickas (2001) used the word *adapt* in its variant forms 27 times in this chapter, and he used some form of the phrase *self-organizing* 11 times. Furthermore, he emphasized the constructivist utility of a subjective narrative of one's career and supported a model of career that examines "transactional adaptation to the environment" (p. 313). These transactional adaptations are the "fitness peaks" of complex adaptive entities as I have described them.

It is interesting that the ever-widening and ever-narrowing webs of relationships that are revealed in the examination of complex adaptive entities can lead to an understanding that, as Bronowski (1978) wrote in his introduction to a series of lectures to the scientific community, "the world is totally connected: that is to say that there are no events anywhere in the universe which are not tied to every other event in the universe" (p. 58). This sense of connection is the essence of spirituality. In *A Spiritual Audit of Corporate America*, Mitroff and Denton (1999) found virtually unanimous agreement on the definition of spirituality among executives, managers, and workers at all levels in a variety of industries. In essence, the definition had two components. The first was that spirituality included a sense of connection to something beyond the individual; the second was that spirituality is a search for meaning, purpose, and integration in life. In this article, I explore how the currently prevailing scientific paradigm, careers, and spirituality are all entwined, thus stressing relationships and meaning.

The New Theory

This article presents a new theory of complexity, connections and careers by (a) describing the characteristics of complex adaptive entities and nonlinear dynamics; (b) applying the principles of complex adaptive entities to careers; (c) developing conceptual links among the ideas of nonlinear dynamics, career development, and spirituality; (d) presenting a brief case analysis using complexity theory; and (e) discussing possible implications of the theory for practice and research. (When I searched the databases listed above using the term *spiritual**, I found no reports of research or theoretical articles.)

Characteristics of Complex Adaptive Entities

Complex adaptive entities share common characteristics whether they are being described in physics, in biology, or in the social sciences. Eleven of these characteristics are described briefly in this section. It should be noted that I have identified these characteristics from a broad base of readings and observations (see the Appendix for a list of the background readings). The characteristics do not exist independently in some ob-

scure, or familiar, text on complexity science. Certainly, others writing in this field might isolate a somewhat different list or combine the elements of this list into a different order. In the next section, each characteristic is applied to career development.

1. Complex adaptive entities, referred to from this point on simply as entities, have the ability to maintain themselves, although their components and even their shapes may change. In this sense, they have life. Life is the ability of the entity to maintain itself, or *autopiesis*. Life is self-organizing, not controlled externally. Life is the ability to adapt internally to changing environments (Maturana & Varela, 1972/1980, 1987).

2. Entities are open, that is, they maintain themselves through the on going flow and interchange of components or energy.

3. In these exchanges, entities are part of networks. Any entity is part of many networks, which can be depicted not only as concentric circles but as ever-widening links to nodes beyond the entity itself. At the same time, a particular entity may have networks operating within it (Barabasi, 2002).

4. Entities are parts or fractals of other entities. Each fractal has the entirety of the organism within its shape. Ultimately, every organism may be seen as a fractal of the universe. Fractals reveal themselves as irregular structures that are self-similar at different scales of manifestation (Mandelbrot, 1982).

5. Entities are dynamic. In the constant exchange of forms, components, and energy, they move between order and chaos. These *phase transitions* are comparable to the movement of water among its three phases: liquid, solid or ice, and gas or steam. Phase transitions are the opportunity for creativity and the emergence of new forms.

6. During phase transitions, entities seek fitness peaks, that is, the point that will yield the greatest chance of survival. Kauffman (1995) wrote,

> I suspect that the fate of all complex adapting entities in the biosphere—from single cells to economies—is to evolve to a natural state between order and chaos, a grand compromise between structure and surprise. . . . The edge-of-chaos then also arises as a potential general law. In scaling the top of the fitness peaks, adapting populations that are too methodical and timid in their explorations are likely to get stuck in the foothills, thinking they have reached as high as they can go; but a search that is too wide ranging is also likely to fail. (p. 15)

7. Phase transitions are best explained by nonlinear dynamics. In linear dynamics, there is an expectation that changes of equal sizes will produce equal effects. There is also the assumption that causation is, if not unidimensional, then easily studied through multiple regression methods. Complex entities, however, behave in nonlinear ways. Because the transitions between order and chaos are drawing on multiple causes from multiple network relationships, from a continuing interplay of the internal and external, it is often what would have been considered "noise" in reductionist science that is of most importance in understanding the dynamics of nonlinear entities.

8. Small change brings about large effects. Within the nonrecurring, nonlinear patterns, small changes may be seen to bring about large effects. This phenomenon, known as *sensitive dependence*, is a quality of all complex entities. No matter how similar the starting states of dynamic entities, one can be sure that they will "drift apart" after a while (Banks, 2000).

9. As the entity moves through its transition, it may retain its life and shape in response to several types of attractors that limit its movement and growth. These limiting attractors can be described as *point attractors, pendulum attractors,* or *torus attractors.* As the name suggests, an entity shaped by a point attractor returns repeatedly to the same state as if drawn by a magnet. An entity shaped by a pendulum attractor moves back and forth between two identifiable states, just as a pendulum swings from side to side. Finally, an entity held in place by a torus attractor moves around, and again around, in a circular pattern. Patterns formed by torus attractors are often described as doughnuts, or bagels, as round and round the same circle the events go, never exactly repeating themselves, but never leaving the circumscribed area. Imagine the events sketching the doughnut. The more similar the events, the closer the pencil lines will be to the center hole; the more varied the events, the further out along the edge of the doughnut the pencil lines will be.

10. However, as the entity moves through its transitions, it may retain life through the creation of new forms, a quality known as emergence. *Strange attractors* yield entity shapes that are neither linear nor contained. When they are plotted mathematically, the patterns form unique figures or fractals.

11. Complex adaptive entities exist only as part of nested inseparability or connectedness. In other words, there are no living systems without interdependence. Spirituality is the experience of this unity (Ainslie, 1995; Goerner, 1994, 1995; Kauffman, 1995).

To sum up this section, complex adaptive entities, from evolution to single cells, can be described as self-organizing structures that adapt for continuing being, with connections along networks that allow for open exchange of matter and energy and with the ability to use the border between order and chaos for the creation of new forms and for emergence to occur. In this border between stability and change, life is unpredictable. Small differences in initial conditions, as well as small changes in the environment, may result in wildly different results. The moments on the border between chaos and complexity afford the greatest opportunities for growth (and conversely for failure). In the next section, each of the 11 points is applied to careers.

Applying the Principles of Complex Adaptive Entities to Careers

Living in the nondeterministic world of complexity is confusing to humans. Humans look for patterns, often yearn for certainty. Given the actuality of life and the predisposition to seek order, individuals often experience their own careers as illogical, having no clear relationships between actions and reactions. They believe there is some sequence of work roles that they are expected to follow. They believe that others make career decisions based on logical links of past experience and that others expect this logic of them as well, but that is not what most people experience. That is why many people seem to keep the real stories of their careers secret. They keep to themselves the strange links between events, links they describe as "just luck" or coincidence. In truth, it is the secret career stories that reveal the reality. Career paths are characterized by unexplained trajectories and apparent, but not actual, disconnections.

Because human beings are complex, adaptive entities, the characteristics of such entities that were identified in the previous section are evident in their lives, and, on a smaller scale, in the complex adaptive entity of their careers. The characteristics include the following elements: (a) autopiesis, or self-regeneration; (b) open exchange; (c) participation in networks; (d) fractals; (e) phase transitions between order and chaos; (f) the search for fitness peaks; (g) nonlinear dynamics; (h) sensitive dependence, or the potential for small changes to bring about large effects; (i) attractors that limit growth; (j) the role of strange attractors in emergence; and (k) spirituality.

Autopiesis or self-regeneration. People continually reinvent their careers, moving freely among, within, and outside the macrocycles and roles previously identified as the anticipated career paths of "healthy" individuals. Whether or not people receive career counseling or participate in any career education programs, they have careers. This is not to suggest that the efforts of the career counseling profession are in vain or even unnecessary, but to point out that the original idea that career development is a natural, internal process is borne out by the acceptance of career as a complex adaptive entity.

Open exchange. Career requires a living human body in which it functions in continuing exchange with all the entities of that body. In addition, career cannot take place for the individual alone. By its very nature, career requires participation in the give-and-take of the outside world. These relationships are complex and dynamic but nevertheless hark back to the foundational work of Frank Parsons.

Participation in networks. The relationships among the physical, psychological, neural, and spiritual aspects of the individual are, however, neither unitary nor linear but exist in interweaving networks. So, too, career is an entity within the entity of the individual, but it is also part of the surrounding networks of education, occupations, industries, particular employers, needs of the community, local and global economies, and cultures—to mention just a few. These are ongoing relationships that operate, affect, and are affected by the entity of each career.

Fractals. The career of any person is a fractal of that person's entire life experience. In addition, it is a fractal of the entire work and economic system. Because career is a fractal of an individual's life, in examining a career, an individual sees the patterns and dynamics of the whole life. In addition, the careers of many people are fractals of the workforce experience. They are fractals in that these parts are similar to the whole. Like a hologram, they show the same features at different levels of examination—from the closest look at the smallest element to the most distant view of the whole shebang.

Phase transitions between order and chaos. From a state of being fixed in school or work, an individual is thrown into change, from order to chaos. Because careers are part of relational networks and, further, because the networks are in continual open exchange, career changes occur. These career changes may be sought or thrust upon the individual, but they are always part of the relational network whether experienced as such or not. In this model, graduation, being fired, ambition, illness, and virtually any event are all potential sources of phase transitions.

Search for fitness peaks. During phase transitions, career is characterized by the search for the best that each individual can imagine for her or

himself. However, like all entities, the career search for fitness peaks may be limited by excessive timidity or by risk taking, as well as by the net worked relationships and exchanges taking place all the time. With each phase transition, the individual again becomes an explorer of her or his own career.

> Explorers live or die by first impressions. Is the approaching inlet a shelter or a shoal-strewn trap? The figures beckoning from the beach — are they friends or foes? Act too cautiously, and you will discover nothing. Too recklessly, and you may end dashed against rocks, or, like Magellan, lying on the sand with a spear through your gut. (Horwitz, 2002, p. 248)

Nonlinear dynamics. Each person's career development pattern makes sense in terms of that person's work life, the specific dynamics of the environment in which it occurred, and the internal dynamics of that person. So, too, people experience parts of their careers that seem to form patterns for them, but these patterns are either not explicable, or are only partially explained, in terms of the patterns of other careers. The career development of each individual is a series of choices that have internal harmonics or resonances for that individual and can only be understood in terms of that individual.

Sensitive dependence, or the potential for small changes to bring about large effects. Apparently random, often small, events may lead to major career shifts. These small changes can range from distant perturbations of the economic scene to responses to a previously ignored interaction at work. Consider the person who simply walks away from a job because of the proverbial final straw.

Attractors that limit growth. Some careers appear to be formed by point attractors. Individuals with *point attractor careers* see only one occupation as possible and, often, only one route into that occupation. For example, unforeseen changes in personal circumstances or occupational opportunities, such as industrial shifts or international outsourcing of particular types of jobs, leave such individuals with no sense of options or even possible areas of career exploration. Other careers appear to be formed by pendulum attractors. Individuals in the grip of pendulum attractors may be unable to move forward, caught in the inertia of indecision. Still other careers appear to be formed by torus attractors, that is, patterns are clearly repeated with slight differences in each repetition. Careers formed by torus attractors may feel comfortable, but the awfulness of the repeated trajectory is the illusion of change followed by the reality of being stuck. With each circuit, there is awareness of the hole in the doughnut, the abyss of the "stuck" existence.

Role of strange attractors and emergence. Strange attractors allow careers to take new shapes and emerge in forms quite varied from those seen before. Life has surprises; unexpected trajectories arise. Even in careers in which an individual has stayed within one occupation and industry, emergence is present to the extent that the individual continues to learn—therefore emerge—creating a sense of satisfaction, flow, and even joy. Fairy tales and legends of all cultures often reveal common strange attractors. In the tale of Sleeping Beauty, the prince's kiss is the strange attractor that moves the princess from the state of sleep to the state of wakefulness. However, it is the waiting for the kiss, the waiting itself, that is

another attractor that keeps her asleep. In the story, the poisoned apple is the external circumstance, the strange attractor that puts her to sleep. Princes do not get off any easier in legend. The prince, too, awaits the kiss of the beautiful maiden to turn him from the outward ugliness of a frog into his true self, or the prince wanders forever in the woods, searching for the princess he must rescue and kiss.

The phenomenon described as "planned happenstance" (Mitchell, Levin, & Krumboltz, 1999) is another way of describing these aspects of nonlinear dynamics. By examining the career decisions that arise through what appears to be serendipity, one sees the operations of strange attractors and the resulting emergence.

Spirituality. Complex adaptive entities exist only as part of nested inseparability or connectedness. In other words, there are no living systems without interdependence. Spirituality in work is the experience of this unity. Career counseling is, in this sense, spiritual counseling.

Links Among Complex Adaptive Entities, Spirituality, and Career Development

The similarities between the principles and effects of nonlinear dynamics and spiritual beliefs have been noted by writers in more than one discipline. Kauffman (1995) described his work in evolution as "rediscovering the sacred." The noted economist W. Brian Arthur has described the complex approach as Taoist: "the universe in Taoism is perceived as vast, amorphous, and ever-changing. The elements always stay the same, yet they're always rearranging themselves" (Waldrop, 1992, p. 330). Ainslie (1995) and Goerner (1994, 1995) have shown how the principles of nonlinear dynamics link spirituality and psychology. In contemporary descriptions of spirituality, there seems to be the commonality of a sense of connection (Mitroff & Denton, 1999). One may envision this as a connection to something larger than oneself or to something deeper, but it is beyond the material world. At the same time, it is the material, and the something larger and deeper and, indeed, oneself are all "it," because "it" is the connection, the sense of oneness.

The search for oneness is the essence of all spiritual beliefs and is expressed in many religions. In Christianity, the worship of the Trinity—the Father, the Son, and the Holy Spirit—is also the worship of One. This is known as the Mystery: three persons, one God. In Judaism, a central prayer begins "Hear O Israel, the Lord our God, the Lord is One." Some people believe that this prayer was written to help the early Jews distinguish themselves from people who believed in many gods. However, another interpretation, one that is consistent with the emphasis generally placed on the word *one* in meditation on this prayer, is that God equals One. This image of oneness is in the ever-repeated image of each of us as a mustard seed in a sphere that is a mustard seed in a sphere that is, in turn, a mustard seed in the sphere of the moon as expressed in writings related to Kabbalah (Matt, 1996). It is Hanh's (1996) lotus flower within each petal of a lotus flower. Both of these images were described long before the discovery of chaos, complexity, and nonlinear dynamics with its relatively new vocabulary, yet both are perfect descriptions of the nested similarity of fractals.

A survey by Gallup and Jones published in 2000 showed that more than three fourths of Americans feel the need to experience spiritual growth in

their lives. Gallup and Jones noted that this percentage is up from 20% in 1994. Wuthnow (1998) has described contemporary spirituality as a "seeking spirituality," one in which people "increasingly negotiate among competing glimpses of the sacred, seeking practical knowledge and practical wisdom" (p. 3). In addition, studies in the United States and Australia show that employees who work for companies that they consider to be spiritual are more productive and that they are less likely to leave those companies (Mitroff & Denton, 1999).

In search of ways to connect spirituality and work, Bloch and Richmond (1997) brought together a group of commissioned writings to explore the connections between spirit and work from a number of theoretical and practical perspectives. From this initial exploration, they moved to the development of practical approaches to help individuals experience the sense of connectedness. In this second work, Bloch and Richmond (1998) identified seven connectors between spirit and work. These connectors may assist individuals in maintaining the sense of interconnectedness, a sense that is otherwise often fleeting and difficult to act on. The seven connectors are as follows:

- Change: Being open to change in yourself and the world around you
- Balance: Achieving balance among the activities of your life such as work, leisure, learning, and family relationships as well as balance between the old and new
- Energy: Feeling that you always have enough energy to do what you want to do
- Community: Working as a member of a team or community of workers
- Calling: Believing that one is called to the work one does by a particular mix of talents, interests, and values
- Harmony: Working in a setting that harmonizes with one's talents, interests, and values
- Unity: Believing that the work one does has a purpose beyond earning money and in some way serves others

These seven connectors also form the basis of an instrument, Salient Beliefs Review: Connecting Spirit and Work (SBR; Bloch, 2003) designed to assess congruence between individual and organizational values. The SBR has been described in an earlier article (Bloch, 2000).

Seeing work as spiritual enables each person to consider his or her contribution to the world, to the ongoing creation of the universe. This view gives value to each career. At the same time that this view may save one from self-centeredness, it also enables a perspective that "Our individual microscale activity in all its uniqueness can count in a way classical science never imagined" (Goerner, 1995, p. 36). Finally, seeing one's career as spiritual avoids the moral schizophrenia between life and work. It adds both an ethical dimension and a dimension of love to work.

Case Analysis: Marion's Calling

This section of the article presents the case of Marion and then applies complexity theory to analyze it. The purpose of this section is to show how complexity theory can offer a new perspective and approach to familiar situations.

The case. Marion is a 58-year-old counselor who has worked in social service agencies since obtaining her master's degree and state licensure

28 years ago. Getting a degree in counseling had not been easy, but Marion felt called to counseling and had managed to get her degree by combining part-time work and part-time study. When she began work in her first job, she knew that the sacrifice had been worth it. Marion has now been with the same agency for 15 years. In the past 10 years, she has moved into more administrative roles within the agency. At first, Marion enjoyed the new challenges posed by her leadership responsibilities. Marion also appreciated the recognition of her combination of abilities that led the upper management of the agency to move her higher and higher in the organization. In the first few years in leadership positions, Marion was able to reserve specific hours each week for work with clients; however, as her leadership responsibilities increased, her opportunities for client contact decreased.

Now, Marion felt depleted. She felt she no longer had anything to give to the agency or to clients. She questioned her earlier sense of calling and wondered what to do next. She felt that she had dealt too often with the same agency issues, had solved those she could, and was just wasting her time trying to patch those problems that could not be solved. On the rare occasions in which she interacted with clients, it was only to help them navigate the shoals created by the unsolved agency problems. Instead of feeling a sense of satisfaction in working with clients, Marion felt annoyed by them and guilty about her annoyance. Yet, Marion was not ready to retire. She looked forward with dread to the next years in which she would just be marking time. She was too young to retire, yet too tired and unhappy to stay where she was. Marion began to think about how she could move into management positions in other fields, but none seemed particularly attractive.

In the course of her work, Marion attended a small conference of counselors working in similar agencies. Not at a workshop but at an informal gathering, one of these counselors spoke of her own sense of calling and how it affected her work with clients. The proverbial light bulb went on in Marion's mind. She had not lost her calling, but her current work situation did not allow her to enact it. Marion recognized that, indeed, she needed to stay in the field but not in her current job.

The analysis. Marion's distress was a sign of phase transition. Internal dissatisfaction with her environment was taking its toll on her emotional well-being and on her health, as evidenced by her fatigue. Marion was caught in the grip of a torus attractor as around and around she went in the endless cycle of problems caused by the low funding and high client demand faced by the agency. Each year she thought the promotion or shifting of her responsibilities from one unit to another would make a change. Yet, with each change, the situation remained the same. As her sense of "fit" with the environment waned, she moved closer to the border between order and disorder. She was in a state of high sensitive dependence. Indeed, this was the kind of situation in which less controlled people may experience "the straw that broke the camel's back" and simply quit in a moment of anger. Fortunately for Marion, she found herself in a situation in which another attractor was presented, an attractor that fostered emergence. Hearing the younger counselor speak of her sense of calling brought Marion back to her own younger sense of self. She left the meeting prepared to take the risk of leaving her current job, but knowing that she wanted to remain in the field, indeed return to counseling. Her calling, her personal strange attractor, was strengthened.

Of course, this is not the end of the story. Marion may need help to follow the moment of inspiration she experienced, and she now needs help in identifying the kind of job or self-employment that will enable her to work directly with clients and provide the level of income and other job satisfaction factors that she needs.

Implications for Practice

I am grateful to participants in two workshops—in Melbourne and Sydney, Australia, in February and March 2003—for their contributions to the implications of the theory for practice.

1. In working with individuals, understand that the opportunity for creativity occurs at the transition points. Everything depends on (a) recognizing phase transitions, (b) recognizing attractors of the past, and (c) seeking fitness peaks.

2. Classic career development theories and related instruments and methodologies of structure and processes explain parts of the whole but are not additive. The place to begin in practice is with the whole.

3. Mosca (1995) suggested that narrative and play are the most effective methods for helping clients and students seek happiness. He defined happiness as

> [T]he potential to be totally consonant with what is as it unfolds. It implies the nonjudgmental transcendence of the linear blandishments of point, limit cycle [pendulum], or carefully tessellated tori attractors. It is allowing oneself to choose to go with the ontogenetic or intuitive drift. (p. 181)

Narrative approaches are certainly not new to career development. As Savickas (1997) wrote, "The empirical tradition of rational career counseling does not encompass complex human qualities such as spirit, consciousness, and purpose. Science examines parts; personal stories explain the whole" (p. 9).

4. Listen to the stories to help individuals find the links and nodes of their networks. Use storytelling to help clients identify who they are—not just their occupational titles—and where they fit in the larger picture.

5. Provide paper and crayons or markers or other means of expression through playful activities.

6. Knowing that change is inevitable but uncomfortable, use the concepts of complexity theory to help reduce client discomfort. Help clients recognize their transferable skills as a way of reducing the discomfort of chaos.

7. Help clients understand the power of small changes and help them identify those they might attempt.

8. Explore how individual careers are kept alive: by point attractors, pendulum attractors, torus attractors, or strange attractors. Career interests, career anchors, social and socioeconomic constraints, habits of mind, and other internal and external factors are examples of possible attractors. Identify one's own patterns and dynamics and how they influence one's work.

9. Help clients and students appropriately assess the degree of risk that is appropriate during phase transitions.

10. Help clients who want to rush off the edge of chaos to see where, in the past, the rushing itself has been a torus attractor and led to nonsatisfying

outcomes. Recognize one's own discomfort at the edge of chaos and do not rush clients away from the edge of chaos.

11. Recognize the need to feel connections—the spiritual aspect of work—and make a space for clients to discuss this in their stories or play.

12. In career education or career development programs, stress the opportunities presented by phase transitions because change is the only certainty.

Implications for Research

1. Avoid quantitative studies that ignore small differences in measurement. Kellert (1993) asked, "Why was this limitation so unexpected and so unwelcome?" and answered, because there is an assumption in Western science that one does not have to take into account a small difference or vagueness in measurement. "[T]his assumption, that a small amount of vagueness in measurements will lead to only a small amount of vagueness in predictions, meets a direct challenge from entities with sensitive dependence on initial conditions" (Kellert, 1993, p. 43).

2. Avoid studies that examine phenomena in isolation. This is related to the "view that the universe should be approached as a collection of individual entities with nonrelationship properties," properties that researchers mistakenly believe "have a pre-existing and infinite degree of accuracy, which justifies their representation by real numbers" (Kellert, 1993, p. 46). In career development, this means avoiding studies that center on isolated assessment of interests, values, family background, or any of a host of variables to which numeric or alphabetic codes are assigned.

3. Foster studies that use case study and other qualitative methodologies to develop pictures of how the networked interrelationships and nonlinear dynamics of phase transitions and attractors work in the complex adaptive entity of career so that through the examination of an increasing number of cases, counselors can arrive at approaches that are more and more useful and that still recognize the uniqueness of each individual.

Conclusion

William Butler Yeats (1928/1962) began the poem "Among Schoolchildren" by describing a man questioning a nun about the children in a classroom. The nun says,

> The children learn to cipher and to sing,
> To study reading-books and history
> To cut and sew, be neat in everything
> In the best modern way— (pp. 114–115)

Modernism, classic physics, and classic career development were all based on the same model, a model that has continued to influence much of Western thinking even into the 21st century. It is a model of orderliness. Within the orderliness, all could be separated and then recombined because there was a right way to be found. Indeed, one could cut and then sew. But listen to the final verse in which Yeats (1928/1962) rejected that model.

> O chestnut tree, great rooted blossomer,
> Are you the leaf, the blossom or the bole?
> O body swayed to music, O brightening glance,
> How can we know the dancer from the dance? (p. 116)

This is the picture of the world that has been shown through the work of physical, biological, and social scientists who embrace nonlinear dynamics. It is a picture of wholeness and relationship, of ever swirling dynamics, of dancing molecules, and of work that is intrinsically and inextricably linked to the essence of each individual and the whole of the world in which we individuals live.

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APPENDIX

In addition to the references cited, the following background readings contributed significantly to the ideas presented in this article.

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