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ScienceDirect
Journal of Vocational Behavior 71 (2007) 375–400
Journal of Vocational Behavior
www.elsevier.com/locate/jvb

Applying Chaos Theory to Careers: Attraction and attractors

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Received 26 April 2007
Available online 21 May 2007

Abstract

This article presents the Chaos Theory of Careers with particular reference to the concepts of "attraction" and "attractors". Attractors are defined in terms of characteristic trajectories, feedback mechanisms, end states, ordered boundedness, reality visions and equilibrium and fluctuation. The identified types of attractors (point, pendulum, torus and strange) and their relevance to career development are described. The attractor concept is then applied to major barriers in career development and life transition by a consideration of closed and open systems thinking. It is contended that ultimately the context of human experience is an open system and that career development difficulties arise when closed systems thinking is used in an open systems reality. The practical counseling applications and counseling research evidence using attractors are briefly reviewed. The additional potential contributions of the Chaos Theory of Careers to the career development field are also outlined.

Keywords: Attraction; Attractors; Chaos theory; Closed/open systems; Career development

1. Introduction

Many of the models that psychology has utilized over the last 100 years or so have been derived from other sciences or the philosophy of science. Hence the positivist, reductionist and prediction perspective of so much 20th century psychology can be seen to be the result of the application of logical positivism as a philosophy and laboratory-oriented

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0001-8791/$ - see front matter © 2007 Published by Elsevier Inc.
doi:10.1016/j.jvb.2007.05.002

experimentation as the research method paradigm. The field of career development theory also has been a regular borrower of conceptualizations in science in general and in other domains of psychology in particular. Among the obvious examples are Super's (1957) incorporation of "self-concept" personality theory, Roe's (1956) incorporation of Freudian ideas, the social learning theory of career decision making (Mitchell & Krumboltz, 1990), Super's (1980) revision of his theory under the influence of life span psychology, social cognitive theory (Lent, Brown, & Hackett, 1994) and Patton and McMahon's (1999) adaptation of systems theory.

While at first such appropriations might suggest a singular lack of imagination and creativity on the part of most career development theory developers, further reflection uncovers a different perspective. If there is a coherent unity to reality, a fundamental assumption of all traditional science (Davies, 1992), then explanations of some kinds of events and behaviors should reasonably have applications to other events and behaviors. Indeed we often judge the worth of a theory by the breadth of its application (Greene, 1999). Thus it seems not only defensible to take concepts from one scientific domain and apply them to for example, career development, it appears laudable since the power of great scientific theories is in their ability to link apparently disparate and unrelated phenomena to one another through some general principles. Indeed even career development counseling has drawn inspiration from the physical sciences as instanced in Amundson's (2003b), "The Physics of Living".

Therefore, it should not be surprising that the more recent developments in the physical sciences which appear to have undermined many of the claims of positivist-reductionism, would find their incorporation into career development theory. Chaos theory has been designated the "third revolution" of 20th century science—the first two being relativity and quantum mechanics (Moore, 2002). For at least 20 years psychologists have been interested in how such concepts may assist in providing a new understanding of thinking and behavior (Butz, 1997). Most of these applications have been in clinical psychology but more recently career development writers have begun to display increasing interest in both chaos theory and complexity theory (Bloch, 2005; Bright & Pryor, 2005a).

Why should not the same fundamental principles and perspectives which assist us to understand the nature of the physical universe also apply to the psychology of human thought and behavior which are as much a part of that universe as the Bernoulli Effect or black holes in space? Some modern organizations now look to the natural world and its capacity for adaptation and decentralization as models for the way they structure the working environment and work processes of their employees (Jacobs, 2000). Moreover, the reason science reveres Isaac Newton is that he demonstrated how the same underlying principles explained such diverse phenomenon as the movement of tides, the orbits of planets and the fall of an apple. It is such thinking that we believe, justifies the application of chaos theory not only to human thinking and behavior in general but also to career development theory and behavior in particular. Thus we asked ourselves could the same theoretical perspective which addresses Poincare's "three body problem" of planetary prediction and Lorenz's computer programs uncovering the essential unpredictability of the weather (Peat, 2002), also apply to those negotiating career transitions? In fact if connectedness is an essential aspect of reality (Barabasi, 2003) it makes eminent good sense, that career development theory should find explicable links to psychology in general and in turn, to all science and ultimately to all human quests for understanding. That there are applications of chaos theory in politics, economics, arts, theology as well as the

sciences, suggests the reasonableness of this expectation and of the aspiration to develop the chaos theory of careers.

Moreover in the last 15 years or so a new set of concepts have been used to describe the realities of career development and life transition that are either (consciously or unconsciously) derived from or compatible with chaos theory formulations. Among these are "positive uncertainty" (Gelatt, 1991), "emergent qualities" (Leong, 1996), "happenstance" (Mitchell, Levin, & Krumboltz, 1999), "bifurcation" (Laszlo, 1991), "contextualism" (Young, Valach, & Collin, 1996), "non-linear change" (Leong, 1996), "systems" (Patton & McMahon, 1999), "luck readiness" (Nealt, 2002) "spirituality" (Bloch, 2000) "career craft" (Amundson, 2003a) "career chance" (Chen, 2005) and 'narrative" (Savickas, 1997). It is our contention that chaos theory represents a theoretical way to integrate these concepts into a holistic understanding of career development and life transition (Pryor & Bright, 2004). However, as well as providing a theoretical infrastructure for already extant ideas and concepts in career development, it seems reasonable to ask: what new ideas, insights and counseling practices can be derived from chaos theory when applied to careers and life transitions? This paper endeavors to outline the application of chaos theory to careers and to answer this question by reference to the chaos theory concept of "attraction" and its instantiation as various attractors (Butz, 1997).

2. Some general background to chaos theory

Lorenz, the famous meteorologist and one of the pioneers of the "discovery" and application of chaos theory indicated that he saw the essence of chaos theory to be "sensitivity to change in initial conditions" of a system (Lorenz, 1993). This gave rise to the well-known Butterfly Effect which is simply the observation that small changes in complex systems can result in disproportionate (non-linear) changes in other parts of the system. Viruses in the internet are obvious examples of this potential effect. For a vocational example, we recall that the outbreak of SARS in China some years back eventually resulted in career counselors having flight attendant clients who had been made redundant by the subsequent downturn in Australia's tourism industry.

Chaos theory in general presents a new vision of our knowledge about the universe and how it operates. The limitations of reductionism, analyzing phenomena by splitting them into every diminishing components, for the practice of science are now abundantly clear (Barabasi, 2003; Peat, 2002). The emergent properties of phenomena are lost in such a modus operandi (Johnson, 2001; Morowitz, 2002). The ultimate cost is that reductionism if rigorously pursued, takes its investigations further and further away from the "real" world as we experience.

This seems too great a loss especially for an applied field such as the study of a career development and life transition. The alternative vision is one of examining phenomena in its complexity and its interconnectedness—that is, as complex systems (Holland, 1998; Prigonine, 1997). Another great challenge for science has been how to integrate being and becoming. Traditionally, science has focused on either the structure of phenomena or the changes that occur in phenomena (Prigonine & Stengers, 1984). By making sensitivity to change an intrinsic quality of the phenomena it studies, chaos theory has the potential to address this issue which has plagued many of humanity's greatest thinkers since the time of Plato. That is, while complexity and interconnection enable systems to be capable self-organizing into coherent and stable wholes (Kauffman, 1995) at the same

time, they render such phenomena susceptible to unpredicted change (Kellert, 1993). Such change may emerge from either the internal functioning of the system or its interaction with its external environment. For example, change in its internal functioning may be seen in a machine wearing out over time or a very depressed person eventually committing suicide. External changes in the ways a system might function could include losing one's job, catching a disease, winning the lottery, being involved in a motor vehicle accident or the birth of another child into one's family.

3. The Chaos Theory of Careers (CTC)

The Chaos Theory of Careers conceptualizes reality as a combination both order and unpredictability. The theory is based in a realist (as distinct from a phenomenalist) perspective (Maze, 1982; Pryor, 1979, 1985, 1991). A realist perspective assumes that we can know the world directly rather than merely know our perceptions of the world (Anderson, 1962). Reality comprises two basic categories: existents and relations (Maze, 1973). Existents are entities that possess properties that can be known and relations are the ways in which existents are related to one another. Existents cannot be defined by their relations but must be identified by their intrinsic properties. For example, it is incorrect to define a painting as "on the wall" since we could change its relation by putting it in a cupboard without in any way prejudicing its intrinsic nature. If we want to define the painting we need to do so in terms of its colors, size, materials and content.

In this sense the CTC opposes those career development theories that are based either consciously or unconsciously on a phenomenalist view of reality. The basic assumption of phenomenalist accounts is that the only reality we know is our perceptions. Typically this results in the self-being conceptualized in terms of a coalescence of perceptions (Pryor, 1985). A current example of the phenomenalist position appears to be that of Patton and McMahon (2006),

> "The epistemology underpinning systems theory holds that the only reality is the reality construed by the observer in interaction with the observed." (p. 180).

If this view is taken to its logical extreme as David Hume (1739) demonstrated the result is solipsism. If all reality is based on the relations between an observer and the observed how can there ever be a sufficient agreement about the nature of that reality for language to have any kind of generalizable meaning? Communication would degenerate into an endless round of defining terms as they were used by one speaker to another. Realist approaches maintain that communication is essentially sharing meaning and shared meaning is based on a common experience of the external objective world. Of course some aspects of what for example, a chair means to one person may not be the same as the personal meaning of a chair to another person. Both will be consequences of their differing experiences involving chairs. However, it is overstating the case to state that such personal interpretations of chairs is all there is, that is, the only reality. It neglects the commonality of our experiences of chairs which can only be accounted for by some reality beyond the idiosyncrasies of our thinking and experience. That is, that chairs actually exist and that we can know them directly. Now sometimes we can be mistaken in thinking something is a chair when it is not, sometimes we make something such as a crate, perform the function of a chair and some chairs may be so unusual in shape and design that we may fail to recognize it as a chair. However, it is the wrong conclusion to draw therefore that perception

is the only reality. Rather what we should learn is, as chaos theory asserts, that reality is complex and that we should expect on occasions to make mistakes in our endeavors to understand and communicate about that reality. In saying this it is also acknowledged that individuals will sometimes act on such mistakes and therefore it is imperative for counselors to be able to understand such mistakes. It also acknowledged that our capacity to know reality is a function of our perceptive capacities but it does not follow that all reality is perception. For example, when we take our dogs for a walk, the reality our dogs experience is different from our own even though we both go down the same street, to the same park and home again. Our dogs for example, are picking up smells, scents and odors that we do not, while we might understand a sign warning about fines for playing golf in the park, which is meaningless to the dogs. Both our dogs' and our own experiences are experiences of reality but in no sense do they necessarily define that reality. At least for humans to believe that we understand all of the complexities of reality or at least all that is worth knowing, is simply as we hope to show, a form of closed systems thinking in an open systems real world. However, having acknowledged the multidimensional complexity of the real world and the differing perspectives that individuals (and dogs!) may have of it, again is not to concede that agreement on what happened and what is real is unachievable. If that were so how could our legal system work, since courts are in the business of working out what occurred and why and what the consequences are for those involved. Of course, this is not easy and sometimes major errors are made, however, if there is no reality beyond perception then how could courts decide about who is in the right and who has broken the law? Indeed the very existence of a legal system with laws demonstrates the need for a community to go beyond pure subjectivity in order to deal effectively with each other and our world. It is for reasons in the context of career development such as these, that we would support approaches such as that of Savickas (2005b) which endeavor to find links between the subjective and objective perspectives of careers. If reality is complex, and it is; if the context in which career decisions are made is complex, and it is; if the individuals making such choices are complex, and they are: then it follows that the more perspectives we can access to begin understanding such complexities (within the practical constraints of career counseling practice) the better.

To take a more pragmatic approach to phenomenalism and its counseling application as "extreme constructivism" as apparently advocated by some systems theorists, we would argue that virtually noone actually lives their lives as though reality is only what they perceive or create. In our experience all people live their lives as "naïve realists"—that is, we all take for granted that there is an objective reality that we know directly and that is not just our perceptions of an otherwise unknowable external reality. We all simply do not go around living our lives doubting the existence of things that we are not actually perceiving. Most of us acknowledge the limits of our powers to create when it comes to external realities such as gravity and do not go jumping off buildings because we believe that by perceiving ourselves as weightless that will make us so. Again as we hope to show, chaos theory is about creativity in human experience but it also about human limitations. Some of these limitations at least, are a function of the realities of a "separate from us" real world. This line of reasoning can be pushed further by saying that equating reality to our perceptions overstates our capacity to negotiate complexity. As counselors we want to encourage individuals to fulfill their dreams and accomplish more than they thought initially possible. However, we consider it a cruel hoax to encourage individuals with slogans such as "you can do anything" or "reality is just what you can imagine". The

objective realities of locations, labor markets, politics, economics, family commitments and physical injury limitations, also need to be understood and confronted in career counseling rather than neglected in an overemphasis of individuals' "positive thinking".

Such distinctions initially may appear esoteric but they are at the heart of conceptualization in career development theory (Pryor, 1985). For example, when Bloch (2005) defines career as a complex adaptive entity she has committed the mistake of "reifying relations". Career is not an existent, it is an emergent property from the interaction of individuals (existents) with world of other existents such as other people, companies, agencies, institutions and employers. Careers have no life of their own independent of the relations from which they arise. People can have careers in the same way they have any other types of experience. However, it is individuals not their careers per se, that act and react in the world.

The Chaos Theory of Careers conceptualizes reality in terms of existents as systems in relation to other systems. Such systems are characterized by complexity, interconnection and susceptibility to change. In short, they are complex dynamical systems (Bright & Pryor, 2005a). Complex dynamical systems can self-organize into order, coherence and resilient stability but they are also "sensitive to change in initial conditions" (Lorenz, 1993).

"Complexity" implies a potential multitude of components of and influences on the system. "System" implies interconnectedness, interdependence and mutuality of functioning. Being "dynamical" emphasizes that as a consequence of being both "complex" and "systemic", chaotic systems are susceptible to change that has characteristics including nonlinearity (disproportion between causes and effect), unpredictability (the causal chain is too complicated to be able to identify a single cause-effect sequence), vulnerability to phase shift (the configuration of the whole system's functioning can transform) and emergence (new properties and capabilities of the system develop over and above those of its constitutive components) (Pryor & Bright, 2003a, 2003b).

Individuals as complex dynamical systems self-organize their lives both in order to survive and to find or make meaning, as a direct result of the complexity of the human brain. Our brains enable us to successfully survive and to render our experience meaningful through our (advanced) capability for pattern making (Kurzweil, 1999). As far as we can tell humans are the most efficient sentient beings on earth at perceiving patterns, making patterns and utilizing patterns. We see relationships, connections, regularities, causal chains, continuities of existence beyond immediate perceptions in our world (Amundson, 2003a). From these patterns we draw inferences about their underlying dynamics and consistencies and we impose meaning and personal significance on the otherwise jumbled sequences of experiences that make up our lives. In doing so we also impose coherence (or system) on these patterns of events through self-conscious reflection on them. This is how we derive at a personal level, human spirituality which is fundamentally a realization of our integration into a pattern of meaning and significance larger than ourselves.

The process of pattern identification is not just one of perception and recognition. Humans act as complex dynamical systems to impose order and meaning on our experiences and our environment. We try to make the world conform to the conceptions of patterns that we learn, test and develop through our experience (Briggs & Peat, 1999). Sometimes we are extremely successful with endeavors such as science and sometimes we are mistaken as in the gambler's fallacy (that is, the belief or expectation that previous chance event outcomes such as tossing a coin, can influence future chance event outcomes,

such as the next toss of the coin—the fallacy being to think that such outcomes can be connected when tosses are each entirely independent and the probability outcome always remains at chance). In this sense, chaos theory through the notion of pattern making, incorporates recent constructivist aspects of current career development theory which derive from pattern perception and pattern making such as narratives (e.g. Savickas, 2005a), metaphors (Inkson, 2007), maps (Pryor, 2003), journeys (Barach, 2003) and voices (Watson, 2006).

Thus individuals developing their careers and experiencing life transitions are complex and dynamical systems acting within a matrix of other complex dynamical systems such as particular employing organizations, community groups, labor markets, the national and global economies and so on. Fundamental to understanding how complex dynamical systems function is the idea of attraction. Williams (1997) argued that 'the most fundamental concept in chaos analysis is that of the attractor'' (p. 175).

4. Attraction and attractors

Chaos theory has its origins in mathematics and the physical sciences (Kauffman, 1995). In such contexts the concept of attraction is used to give an account of how natural systems function. That is, attraction can be understood as the process by which a system self-organizes into coherence and adapts to maintain, sustain or recreate such order when subject to change either from internal functioning or external influence. The characteristic pattern of this process is called an ''attractor''. Many delineations of the attractor concept can be found in the general literature on chaos theory (Kellert, 1993).

In the following section six specific ways by which to understand attractors are presented and their applications to career development and life transition are illustrated.

5. Characterizing attractors

5.1. Characteristic trajectories

Kauffman (1995) defined attractors as characteristic trajectories of systems. That is typical ways in which systems operate as systems. An attractor shows a system's long-term behavior (Williams, 1997). Psychologically, such a perspective describes the characteristic way in which individuals react and respond to the environments in which they live. These are the habits, predispositions, traits, abilities and reactions to challenge and change, that constitute the basis for much interviewing, counseling and assessment in career development interventions. Williams (1997) has described an attractor as a system's ''identity card''.

5.2. Feedback mechanisms

Sanders (1998) views attractors as feedback mechanisms that systems utilize by which they can sustain stability, respond to perturbation and initiate change. All the time individuals are receiving feedback about what is happening both to them and to their world. The acquisition of most skills for example, is a consequence of feedback about which actions achieved the desired outcome and which ones did not. Action-oriented theorists such as Krumboltz (1998) suggest that just trying various occupations and processing

the feedback is an effective way to improve career decision making, especially for those who become transfixed by indecision.

5.3. End states

Gharajedaghi (1999) characterized attractors as end states to which systems move. The most obvious physical example of this is the small steel ball sent spinning around the edge of the large metal basin which eventually comes to rest on the flat bottom of the basin. In terms of work a variety of organizational experts (Covey, 2004; Peters, 1987; Senge, 1990) have emphasized the importance of 'a shared vision'' within an organization in order to achieve effective responsiveness to workplace and economic change.

5.4. Ordered boundedness

Attractors can be understood as the boundedness of systems as they operate. Without boundaries to a system, there is no system—just absolute disorder. Attractors in this sense are the limits within which systems operate and by which systems are differentiated from one another. In career decision making this conception applies as the limits of what may be acceptable to individuals for example, in terms of their ethics, motivation or preferences and the limits on their capabilities as a result of their abilities and developed skills. Thus a person who disagrees with gambling may find real estate investment sales work just within acceptable limits but employment in the horse racing industry unacceptable.

5.5. Reality visions

Spirituality has become an increasingly important issue in the career development literature in recent times (e.g. Bloch & Richmond, 1997). Attractors can be understood spiritually as visions of reality—what gives sense and purpose to living. Thus attractors can be seen to reflect individuals' values, sense of worth, identity, meaning making and sense of mission. Attractors are the expression of what matters really matter to individuals. ''Mattering'' is becoming a foundational concept of constructivist thinking in career development and choice (Amundson, 2003a; Savickas, 2005a). If individuals are to convert ''preoccupations'' into ''occupations'' (Savickas, 1997) then knowing what matters to them becomes essential to the choice process.

5.6. Equilibrium and fluctuation

Attractors can be described in terms of their tendency toward equilibrium or fluctuation. As attractors become increasingly closed systems, they tend more towards equilibrium. As systems move closer to equilibrium they start to exhibit repetitious behavior until a crisis occurs (Kossman & Bullrich, 1997). As systems move further from equilibrium they experience more fluctuations due to their increasingly open interactions with their environments. This is associated with less stability and a greater chance of system reorganization. Thus as attractors more closely resemble open systems the more unstable they become, but the higher the likelihood that adaptation can occur. Thus a system that has the potential to break up into chaotic disorder also has the potential to reorganize in new ways (Prigonine & Stengers, 1984). In counseling terms this increases the possibilities

for client transformation and openness to change, since individuals tend to seek career counseling as they experience an increasing sense of fluctuation and disequilibrium.

6. Types of attractors

There is a taxonomy of motion within dynamic systems which Schaffer and Kott (1985) have suggested can be understood in terms of different types of attractors. Chaos theorists have identified four fundamental types of attractors which describe the functioning of all systems. Bright and Pryor (2005a) have sought to apply these to career development as the point, pendulum, torus and strange attractors.

1. *Point Attractor:* This describes a system structured to move toward a single point, place or outcome. Crutchfield, Farmer, Packard, and Shaw (1986) define a point attractor as representing all systems that come to rest with the passage of time. The typical physical representation of such a system is a basin or sink in which objects or fluids move or flow toward the bottom or plug hole. Psychologically this is a description of driven thinking and behavior: ideological or goal dominated thinking and/or obsessional or fearful behavior. Vocational examples of such systems' functioning include professional athletes preparing for major sporting events, workaholic executives, "control-hungry" managers who cannot delegate, the belief in the "career for life", inherited careers and single product companies.
2. *Pendulum (sometimes called the Equilibrium, Limit Cycle or Periodic) Attractor:* This describes a system which functions by regular swings between two points, places or outcomes. The typical physical representation of such a system is a pendulum moving from one pole to the other pole of the swing passing through a vertical point in the process. Psychologically this is a description of bipolar behavior of vacillation in decision making, approach-avoidance and dichotomous cognition. Vocationally this attractor is likely to express itself in role conflict, career indecision, rigid and extreme ideas, occupational stress, risk taking sensitivity, lack of commitment, and divided loyalties or priorities.
3. *Torus Attractor:* This describes a system which functions in a complex and predictable way. Such a system repeats itself either exactly or approximately over time. The typical physical representation of such a system is the maze in which there is only one way through and which leads eventually back to its beginning to start again. Once the solution is found each new time through the maze repeats previous routes to complete the task. This is an example of the attractor exactly repeating. The self-similar variant is akin to a long piece of wire being wrapped around a donut. As the wire circles around the dough, it describes a characteristic loop, that varies only it that each successive loop is a wire's width further around the donut. For most intents and purposes, the Torus Attractor can be thought of as exactly repeating for the minor differences are of little practical consequence in this system. Psychologically, this is a description of routine, habitual and predictable thinking and behavior. In similar situations the influence of this attractor is manifested in typical, consistent, trait-like reactions and responses. Such individuals know that the world is complicated so they seek to keep control by organizing and pigeon holing both people and things. They develop systems for doing things at set times and in nominated places. Consistency, routine, classification, hierarchy and organization are their catch-cries. Vocational examples include the "backroom" technician who just wants to be left alone to do the assembly job he or she has always done; or

the file clerk who has been with the company for many years and though very bored, is just holding on for a few more years to retirement; or the insecure worker who finds any change in his or her work circumstances as a threat and who dreads the feeling of not being in control of his or her work tasks.

4. *Strange Attractor:* This describes a system which functions in complex but inherently unpredictable ways but which at the same self-organizes into emergent order. It does so by establishing a pattern of functioning which is bounded, self-similar but never exactly repeating. The typical (and historical) physical exemplar of such a system is the weather. Due to the multitude of interacting factors combining complexly the precise prediction of the weather beyond about a week in most parts of globe, is unreliable. However, over time emergent patterns of order in terms of seasons and climate are clearly discernible. Psychologically, the Strange Attractor is the 'edge of chaos'' where both the human potential to adapt, develop and grow is manifested along with human limitations of knowledge and influence. The edge of chaos is where change and chance are not seen as opposing forces to order and stability but rather as integrated realities of the fabric of existence. In vocational terms the edge of chaos (EOC) is the conjunction of rational/logical planning and action with creativity/imagination in decision making, to confront the threats and opportunities inherent in what we cannot with certainty, know or control. It is acknowledging that the complexity of reality presents both an affront to the hubris of total control and at one and the same time, the opportunity for originality, personal development and innovation.

7. Closed and open systems thinking

The four attractor types outlined above can be classified into either open or closed systems categories. It is our contention that virtually all significant career development counseling problems can be understood in terms of individuals trying to impose closed systems thinking on an open systems reality and that concept of attractors is the best way to explicate this. Point, pendulum and torus attractors are all examples of closed systems thinking. In essence closed systems thinking seeks to simplify reality in an endeavor to achieve order and control.

Humans goal-set, dichotomize and make routine their worlds in order to control, master and manage unwanted change. While such strategies may be successful in the short term or with a limited range of activities, the potential for unplanned change remains a component of reality for which such attractors fail to account. According the Chaos Theory of Careers the only adequate conception of reality and therefore of career development and life transition, is the Strange Attractor. That is, that the reality of human experience is an irreducibly complex open system or series of systems which ultimately defy complete definition, delimitation and control. To recognize and accept strange attractor or open systems thinking is essentially what it means to ''live on the edge of chaos'' (Pryor & Bright, 2004).

8. Problems in career development and life transitions

One of the applications of the concept of attractors is in terms of understanding problems and challenges that people face in career development and life transitions. The Chaos

Theory of Careers (CTC) conceptualizes the point, pendulum and torus attractors as characterized by closed systems thinking, whereas the strange attractor demands open systems thinking. The fundamental issues associated with the closed/open systems thinking dichotomy are those of client control and client expectations. Essentially those who think in closed system terms seek to gain almost total control over the functioning of the system and expect the system to function in ways which are predictable and stable. However, open systems thinking accepts the limitations of human control and does not expect all predictions about the future to be fulfilled. It acknowledges the short-term stability of most human systems' functioning and at the same time recognizes the need to be prepared for the unpredictable as a consequence of both human attempts to sustain order and also initiate change. Table 1 summarizes the differences between closed and open systems thinking.

While there are important differences between those who characteristically function in patterns typical of the point, pendulum and torus attractors there are some fundamental similarities as well. Such closed systems thinking is characterized by expectations that the unexpected either will not or should not happen. These individuals may believe that they are invincible and in control and have the belief that life should be fair and that they should as a consequence, be treated fairly in their own terms. They are likely to have a strong sense of personal control and not to give very much consideration of the contingent nature of human experience. Such individuals are likely to derive great confidence from perceived order, pattern and stability in the past and as a consequence to believe that while change can occur it is likely to be linear in nature and therefore still able to be controlled through appropriate future planning. Where change does occur or something unexpected happens this is regarded as in some sense, extraordinary. As a consequence it has comparatively little impact on their general beliefs about the person having sufficient knowledge and control of their life circumstances. In particular this closed systems thinking tends to limit the number of inputs into the system to which responses are made. In this sense this thinking is an attempt to simplify reality in order to gain a sense of control over one's experience. Moreover, insofar as this has worked in the past it will tend to be repeated. Thus people are likely to keep doing what they have always done on the basis that it has worked before.

Strange attractor or open systems thinking is premised on the idea of the limitations of human knowledge and control of reality including the system represented by the strange

Table 1
A comparison of closed and open systems thinking

Closed systems thinking	Open systems thinking
The unexpected should/will not happen	The unexpected can/sometimes will happen
"I am invincible"	"I am vulnerable, sometimes"
High risk taking without backup strategy	Risk taking with a backup strategy
"Life should be fair"	"Life has no guarantees"
A strong sense of personal control	A recognition of human limitation
Disregard of contingency	Contingency planning
Confidence in order and the past	Acknowledge the reality of phase shifts
Linearity of change	Non-linearity of change
Exceptions are errors—disregard	Exceptions can be determinative and significant
Limited inputs to respond to change	Creativity in response to change

attractor itself. This thinking is characterized by a recognition that the unexpected can and sometimes will happen. As a result individuals are vulnerable at least some of the time to change over which they have no control. While they would like life to be fair they recognize that life itself has no guarantees. While seeking to control some parts of the functioning of the system this approach acknowledges human limitations in terms of control and the realities of contingency. While order, pattern and stability are recognized from the past and passing into the present, the reality of major change in the configuration of the system and the experience of one's life are also acknowledged as continually potential. This thinking appreciates that the past does not guarantee the present nor the present the future. Also acknowledged is the possibility of change being non-linear in the sense that a small difference may result in very major reconfiguration of the system. Therefore the unplanned and the unexpected are not simply exceptions to the stability and order of reality but are part of its very nature. Once this is accepted instead of being perceived as a perpetual threat to be warded off or a specter to be fled from, change can be construed as a reality to be created and influenced at best and accepted and submitted to, at worst.

Open systems thinking recognizes that it is ultimately impossible to know all the potential inputs into systems and that long-term planning is at best speculative. As the complexity, non-linearity, unpredictability and increasing rapidity of change in the world of education and work are acknowledged and understood, the importance of the distinction between closed and open systems thinking becomes more obvious. However, we do not want to totally disparage closed systems thinking. There are situations and circumstances when closed systems thinking can be effective. Closed systems thinking is likely to be effective in closed systems. However, closed systems tend to be very artificial such as symbolic logic and mathematics. Such systems tend to be defined in linear terms and are based on notions of predictability and stable structure. Closed systems thinking can also be effective in open systems with high levels of stability which frequently act as though they are closed systems. These are likely to be complex systems with highly adaptive mechanisms to resist change. An example might be the human body with a wide range of immune systems and defense mechanisms to resist fluctuations in psychological or somatic homeostasis. Closed systems thinking may also be effective for short-term tasks such as scheduling items for a meeting in the near future. Such systems thinking can be useful when open systems are functioning within their typical functioning range (Strogatz, 2003). Thus complex open systems when not subjected to stressors, pressures or change may function like closed systems and be frequently mistaken for being closed. Thus a clerk in a routine occupation may function at an apparently stable, predictable and relatively happy and adjusted way while that person has regular employment. This is torus attractor functioning. However, with a workplace restructure and an unexpected termination of the clerk's employment that person's psychological stability may be substantially threatened resulting in anxiety, aggression and general disorientation. The clerk is being forced to confront the "openness" of reality in the strange attractor with the "closed system perspective" of the torus attractor. The result is often shock and dismay.

In its ultimate inability to deal with unexpected change closed systems thinking is frequently characterized by a failure to recognize, utilize and create opportunities. There is a fundamental inability to acknowledge what can and cannot be done or known in response to the complexities of reality. Closed systems thinking attempts to deny the non-linear nature of change by believing that change should be and can be controllable. Further such thinking believes that if change is not able to be controlled then reality should not be like this. In essence closed systems thinking fails to recognize the potential of emergence

(Morowitz, 2002) as a consequence of change when new states of the system and the environment in which the system functions, develop and need to be responded to in a proactive way.

Moran (1998) argues that clients can be usefully considered to be strange attractors (and hence open systems). In the clinical realm, Moran argues that when behavior becomes closed and periodic it is often a clinical marker for mental illness. The repeating pattern of obsessive–compulsive behavior of the neurotic is a good illustration of this point. The power of open systems thinking for counseling is to embrace the lack of precise periodicity of our behavior which give rise to hope—things can change. The role of the counselor may be to induce small amounts of perturbation into the system and thus illuminate new and possible additional trajectories for the client.

9. An application of systems thinking analysis: Vocational rehabilitation

In the area of vocational rehabilitation these issues become strikingly obvious in people's reactions to change. As a consequence of a work related accident and/or motor vehicle accident individuals' closed system thinking responses frequently take one or more of the following manifestations:

1. A sense of bewilderment and disorientation, arising from a belief that this could not happen and should not have happened—"what about all my plans for the future?" (point attractor thinking).
2. A response of frustration, anger and a sense of injustice that these things have occurred and that they are extremely undeserved (dichotomous thinking derived from a pendulum attractor perspective).
3. Feelings of depression and a sense of being overwhelmed—"all this is too much for me" (phase shift without adaptation or a contingency plan).
4. Helplessness and feelings of inadequacy—the focus of the person's thinking is on limitations and barriers. Often there is a loss of hope and a belief that nothing now will work because the attractor under which I was functioning previously has now been shown to be inadequate. Thus individuals' closed systems thinking can find them swinging from an overconfidence in their skills and control before the injury to this sense of helplessness and inadequacy (pendulum attractor thinking).
5. A loss of confidence as individuals' vulnerability is exposed. Even though all reasonable steps were taken to avoid disaster or accident—the injuries were still incurred and now such individuals become cynical or defensive about initiating further action. As a result their willingness to take risks in response to change may also decline due to fear of further vulnerability and hurt (torus attractor thinking).
6. A "victim mentality" develops. What they thought would continue changes radically and they have no constructive psychological repertoire with which to respond and so they resort to self-pity (emergent thinking—"I am the victim").

Of course in making these observations we do not wish to diminish the suffering impact of ongoing pain, functional limitation, identity fracture and life style loss of those who have sustained major injuries. Our point however, is that if injured individuals resort to closed system thinking then it is likely to exacerbate such difficulties by inappropriate expectations and inadequate responses to the contingency of reality and their own

experience. Conversely the open systems thinking that the Strange Attractor demands, points to a number of "simple (if sometimes discomforting) realities" of career decision development and life transition.

10. Simple realities of the strange attractor

The challenge of contemporary career counseling is to assist individuals to recognize, acknowledge, negotiate and utilize some simple realities including:

- Our knowledge of ourselves, our lives and our circumstances can be substantial but is always limited.
- Our control of ourselves, our lives and our circumstances can be substantial but is always limited.
- Our ability to predict outcomes of situations is limited not only by the inadequacy of the sources of information we access but also by the complex nature of reality itself.
- Change in life can sometimes be slowed and sometimes avoided but is ultimately inescapable.
- Change can be initiated, influenced and adapted to but sometimes it may simply need to be bravely accepted (Frankl, 1984).
- Unplanned change is highly probable in our experience—we cannot rely on our lives and circumstances not changing (McKay, Bright, & Pryor, 2005).
- Stability and change are both essential components of human experience.
- On occasions the effects of such unplanned change can be so profound as to change our lives irrevocably for better or for worse.
- Some small changes can initiate the transformation of a system and/or a life.

In summary, the Strange Attractor both highlights human potential for constructive and proactive change at the same time as pointing us back to a consequence of complexity that all of us from time to time seek to deny or avoid—that in addition to stability and order, mutability and contingency, are the parameters of our existence. Any conception of reality that fails to accept all of these, will be on the one hand a reversion to closed systems thinking and an inadequate spiritual perspective for life on the other. Through the use of attractor thinking, the Chaos Theory of Careers has sought to integrate dimensions of contemporary career development thinking such as planned happenstance, spirituality, purpose and meaning, positive uncertainty, career craft, career construction and accidental careers (Pryor & Bright, 2004).

In endeavoring to develop the CTC the authors have repeatedly stressed the aspiration to both apply and evaluate counseling techniques and strategies derived from the theory. In the next part of this paper some of these application derived from attractors are briefly outlined and some of the recent research on the effectiveness of chaos theory based counseling is reviewed.

11. Some practical applications derived from attractors

The authors have derived a series of techniques that counselors can use with their clients to identify the influences of the different attractors on client behavior, and some strategies to encourage client's to embrace strange attractor behavior.

11.1. Reality Checklist (Pryor & Bright, 2005a)

The Reality Checklist recognizes that clients commonly misconceive the realities of their circumstances and opportunities through overgeneralization. The checklist's aim is to encourage individuals to reflect more on their actual experience of career development and personal reality. In doing so most discover the dimension of the Strange Attractor is already present and influential in their lives. The checklist is a way of encouraging the client to recognize the chaotic nature of contemporary careers through consideration of their answers and in discussion subsequently with the counselor.

11.2. Complexity Perception Index (CPI) (Bright & Pryor, 2005b)

The Complexity Perception Index (CPI) is designed to measure an individual's typical reactions to continuous change within the CTC theory framework. The components of this approach are: Continual Change; Non-linearity; Phase Shifts; Emergence; Goal or Point Attractor; Role or Pendulum Attractor; Torus or Routine Attractor; and the Strange or Complexity Attractor. The final scale measures Purpose/Spirituality. Self-limited thinking and a tendency to cope with ambiguity through simplifying events to single issues, dichotomies or routines can be seen clearly in the profile along with converging evidence in terms of the client's degree of acceptance of the inevitability of continuous change. Identifying attractor thinking is an important first step in assisting a client who is having difficulty in imagining or implementing new possibilities.

11.3. Luck Readiness Index (LRI) (Pryor & Bright, 2005b)

Luck Readiness is defined as recognizing, creating utilizing, and adapting to opportunities and outcomes occasioned by chance. The Luck Readiness Index assesses eight dimensions: Flexibility, Optimism, Risk, Curiosity, Persistence, Strategy, Efficacy, and Luckiness. It is such characteristics that enhance individuals' ability to cope with or even thrive on uncertainty. Suggested are offered about how clients may develop each of these characteristics for negotiating change and creating opportunities.

11.4. Sometimes magic (Pryor & Bright, 2005a)

This exercise encourages clients to move toward the strange attractor by encouraging them to engage in possibility thinking (Pryor, Amundson, & Bright, in press). The exercise is derived closely from the Sometimes Magic: Celebrating the Magic of Everyday Learning card sort (Vallence & Deal, 2001). Each card has a colorful drawing of an Australian animal with the words "Sometimes Magic HAPPENS WHEN... (for example) I learn". Clients are encouraged to reflect on times past where something magical emerged from an everyday event and how that understanding may transform their current thinking about a career transition challenge relevant to them.

Other counseling techniques such as the use of films in counseling, a parable of complexity, a Butterfly Effect exercise, poetry and forensic style interviewing are other practical applications of concepts from the CTC (Borg, Bright, & Pryor, 2006; Pryor & Bright, 2005a, 2006). In the next section of this paper some of the outcome data from evaluations of these CTC approaches that underline their effectiveness and utility in modern career

counseling are reviewed (for fuller descriptions see, Davey, Bright, Pryor, & Levin, 2005; McKay et al., 2005).

12. Counseling outcome data using the CTC

The principles of CTC attractor perspectives and the methods described above have been implemented and evaluated in our careers practices for several years now. We have used the techniques and measures with medico-legal clients who have suffered workplace injuries, high school students, undergraduates, postgraduates, company employees, and company executives. In addition we have conducted several controlled studies in order to determine the efficacy of the techniques we advocate.

McKay et al. (2005) conducted a waitlist control comparison study, comparing chaos-based counseling with more traditional matching-based approaches. The chaos counseling used the Irrational Beliefs Inventory and an earlier version of the Luck Readiness Index. The themes of change, chance, uncertainty and complexity of influence were emphasized during the sessions, whereas in the traditional group, the counseling focused on narrowing down options and making recommendations based on person-job fit. The chaos-based counseling was as good as or superior to the traditional counseling on every outcome measure including satisfaction with the counseling outcome and several measures of career-related self-efficacy. Furthermore, the chaos intervention continued to be rated as effective one month after the counseling whereas the traditional counseling saw a significant decline in ratings over the same period.

Davey et al. (2005) made a DVD containing interviews with clients who were prompted to talk about their careers using the Reality Checklist to guide the conversations into chaotic themes. This DVD was then presented to groups of clients at the University of New South Wales Careers and Employment Service. The DVD was successful in increasing client career decision-making self-efficacy and career exploration behaviors supporting the use of a chaos video intervention.

These two studies provide some promising support for the CTC approach to career counseling. Other research has confirmed the complexity of influences on career development (Bright, Pryor, Wilkenfeld, & Earl, 2005) and the pervasive impact of chance events in individuals' careers (Bright, Pryor, & Hapham, 2005). In the final section of this paper, the potential contributions of the CTC to the career development field are outlined.

13. The contributions of the Chaos Theory of Careers

13.1. The CTC provides a framework for reconciling being and becoming

Complex dynamical systems self-organize into coherent and resilient structures which constitute observable (in principle) properties of the system. The most obvious characteristic of such complex systems' structures are the interconnections of networks. Indeed Barabasi (2003) claims that it is networks which will provide the impetus for the most fundamental questions for future scientific investigation. He goes on to note that by interconnectivity complex systems achieve both "robustness" (structural integrity) and "vulnerability" (propensity to phase transition). Specifically "the existence of robustness and vulnerability plays a key role in understanding the behavior of most complex systems" (p. 118).

Therefore by moving way from reductionism and acknowledging such implications of complexity it can be seen that existents are both intrinsically structured and at the same time, susceptible to change and transformation, through one and the same characteristic—networking. It is in this way that chaos theory demonstrates its usefulness over and above other systems theory approaches. As Butz (1997) in a different context noted, "...chaos holds answers to transformations in general systems theory" (p. 184). Chaos theory's emphasis on dynamics such as sensitivity to initial conditions, emergence and non-linearity, structure through self-organizing feedback (Butz, 1997) and networks (Barabasi, 2003), constitutes a much more complete account of human behavior than the mere adumbration of influences and processes as a framework. Pryor (in press) has outlined how through the use of card sort techniques that both process (becoming) and outcome (being) can be integrated through career assessment.

13.2. The Chaos Theory of Careers provides a coherent understanding of chance

The reality of unplanned events and their impact on career development and life transition is fairly broadly accepted (e.g. Bright & Pryor, 2005a; Bright et al., 2005; Mitchell et al., 1999). However, rather than just arbitrarily inserting chance into an influence taxonomy as Patton and McMahon (1999) appear to do, the question arises: how can a coherent account of both determinism and indeterminism be provided? Chaos theory sees both as the two outcomes of complexity (Holland, 1998; Kauffman, 1995; Pryor et al., in press). Since attractors can be understood as feedback systems then negative feedback into a complex dynamical system from either within the system or from another system, typically has the effect of causing the system to adjust its functioning to sustain stability. This is deterministic. An example would be a thermostat adjusting temperature in a room or poor results for a student suggesting more study is required. Positive feedback as in a sound from a microphone feeding back into a sound system typically precipitates change and because such change can be non-linear especially in human systems (Strogatz, 2003) it usually has the effect of causing disorderly change in the system. Moreover,

> "...when negative and positive feedback loops couple together, they can create a new dynamic balance—a bifurcation point where chaotic activity suddenly branches off into order". (p. 16, Briggs & Peat, 1999).

Thus in chaos theory stability and instability, causality and unpredictability are not opposites which fight for control of the system in some deistic way. Rather, they are simply ongoing joint processes within complex dynamical systems through which all such systems creatively respond to their experience. In career development terms this points to the potential for creativity in each and every individual. It may not be the creativity of a Shakespeare or Einstein but it is the possibility of genuine self-insight and wisdom along with the capacity to responsibly create a personally rewarding career. Therefore the current constructivist models so popular among many contemporary counselors actually have their ultimate conceptual foundations in chaos theory.

13.3. The CTC provides insight into how we might conceptualize "career wisdom"

The CTC illuminates what "career wisdom" might look like. The concept of "wisdom" has attracted some interest from psychologists (Sternberg, 2003) however in the field of

career development it is difficult to locate publications which deal with it explicitly. However, chaos theory's vision of reality in terms of the strange attractor suggests what being wise might be. Fundamentally being wise is equivalent to "living on the edge of chaos" (Lewin, 1999). An alternative way of expressing this would be thinking and acting in accordance with the spiritual dimensions of the strange attractor. What these accounts indicate is that true wisdom comes with the acceptance and embrace of the "boundaries of our being" (Tillich, 1963). In chaos theory such parameters of existence are the interplay of structure and change, being and becoming, stability and surprise, the planned and the unplanned, the probable and the possible (Pryor et al., in press), routine and opportunity. Wisdom is to live responsibly and responsively in light of the contingency of our lives, recognizing our limitations and utilizing our potential.

Moreover, chaos theorists such as Briggs and Peat (1999) appear to agree with the great spiritual teachers of the past, that the key to living wisely is to accept and take hold of paradox. For example, from the Judeo-Christian tradition Jesus of Nazareth frequently expressed his teaching in paradoxes: you have to die in order to live; true freedom is found in obedience; the greatest must be the least; true leadership is service; humility is the foundation of greatness; the first will be last and the last first; in giving we receive and so on. It is therefore no surprise that in the career development field, one of the most quoted publications of the last 20 years has been Gelatt's "Positive Uncertainty" (Gelatt, 1991). The title is a paradoxical expression and his fundamental principles for dealing with career development change are expressed as paradoxes: Be focused and flexible; be aware and wary; be objective and optimistic; and be practical and magical.

It should be pointed out that in using the term "paradox" what is not meant is "duality". That is, things are not for example, either ordered or disordered, they are always both ordered and disordered. For example, making career decisions includes personal control elements such as planning, strategy and constructive action. However, such decisions also include uncertainty elements such as incomplete knowledge, non-linear change and unpredictable outcomes. Career decisions are not all control or all uncertainty. To think in dualistic terms like that places us back in the pendulum attractor in which dualistic thinking reigns. Rather, strange attractor or open systems thinking, recognizes that all human experience has components of order and disorder. Career wisdom is being able to recognize and utilize the paradoxical parameters of our experience to construct lives of worth, meaning and significance.

While it is not our intention here to provide a comprehensive outline of "career wisdom" what we hope to have demonstrated is that the CTC has the potential to introduce into the career development field what most career counselors ultimately seek for their clients. Career counseling seeks not only to address individuals' immediate career concerns, it also endeavors to provide for clients, insofar as is possible, the empowering skills to be able to confront effectively the ongoing subsequent challenges of each person's career development. In other words we want those who come to us for help to obtain "career wisdom" for living in a world of "career chaos" (Harkness, 1996). In addition such career wisdom acknowledges both the advantages and the limitations of the closed systems attractors (point, pendulum and torus) and utilizes them as appropriate within the overarching dynamics of the strange attractor. For example, organizing and systematizing information relevant to individuals' careers can be a useful and helpful activity as long as the restrictions of accuracy and comprehensiveness of such information is still kept in mind when such information is being used as a basis for action.

13.4. The CTC provides a theoretical basis for linking spirituality and science

Career development writers and practitioners have become increasingly interested in incorporating spirituality into career development theory and practice (Bloch & Richmond, 1997). However as with chance there has been a general theoretical failure to demonstrate coherently how spirituality and science (and more particularly career development) can be linked. We are simply told that people seek to construct lives that have harmony, joy, meaning, balance, love, connectedness and so on. However the ways in which such concepts integrate theoretically into the processes of career development are virtually left unexplored or at least, unexplicated.

The CTC through the concept of the attractor, provides a theoretical account in which spirituality is integral to how individuals and groups, function as spiritual entities. The CTC contends that it is the spiritual dimensions of existence for each individual or group of individuals that determine the boundedness of their attractors. In terms of action the boundary of individuals' attractors can be determined in part, by what they think they can or cannot do. However this boundary is also a direct function of what the person believes is ethically acceptable and personally meaningful. Humans as complex dynamical systems interact with their environment the self-develops as an emergent quality of these interactions.

This emergent self-develops and incorporates on an ongoing basis the individual's sense of personal identity, skills, values, morals and other social and spiritual aspirations. The spiritual dimensions of such a development are evident in every culture because it is symptomatic of every society's endeavors to self-organize responsively the experience of the mysteries and uncertainties of our existence. Religion is the collective response and spirituality is the individual response. Culture can be understood conceptually in a directly analogous way as emergent influences on the boundedness of the strange attractors of personal and collective complex dynamical systems.

13.5. The CTC highlights the potential of non-linearity as a key to personal change

The CTC's emphasis on non-linearity is a cause for hope and opportunity for counselors (Chamberlain and Butz, 1998). If small changes have the potential in complex dynamical systems to produce far reaching effects and even phase shifts, then counselors should be encouraged to address even the most intractable of clients' problems. By seeking what it is that brings meaning, purpose, joy and worth to their clients counselors can begin to use this as a foundation for client motivation to change (Briggs & Peat, 1999). Since change can be non-linear the CTC suggests that even small changes in individuals' behaviors have the potential to effect ongoing change eventually snowballing into personal transformation (phase shift). At this point the CTC links with social learning approaches' emphasis on initiating action as a basis for counseling (Mitchell & Krumboltz, 1990).

13.6. The CTC explains why metaphor has become such a powerful conceptual and useful counseling tool in career development

The idea of using metaphors to explain career development and to assist individuals in their career decision making has become quite common (Amundson, 2003a; Inkson, 2007). The CTC provides a theoretical explanation for this development in career theory and

practice through a concept derived from attractors. The "fractal" is a map, representation or trace of the functioning of an attractor. Since attractors have their origins conceptually in mathematics. The original fractals were numerical in content. However, computer technology enabled these mathematical formulations to be translated into images and the result has been most of the computer graphics with which any users of screen saver or media software will be familiar.

In career development, mind maps and collages have been suggested as ways to "capture" the fractal of an individual's career (Adams, 2003; Pryor, 2003). A particular attribute of fractals is that they are self-similar at different levels of generality. For example, a coastline at the level of a small rockpool has similar characteristic forms to the shape of an inlet, which in turn in similar to a bay, which is similar to an entire coastline (Briggs, 1992).

Fractals challenge us to acknowledge the approximate ways that traditional quantitative science has dealt with phenomena such as coastlines or vocational interests, by neglecting the space in between the units of measure. Maps of coastlines typically smooth out the detail of irregularity (the roughness, the openness, the jaggedness and the dendriform) of objects measured (Mandelboit, 1982). However, once self-similar fractal dimensions and their networked interconnections are considered suddenly,

> "A fractal aesthetic encourages us to explore the rich ambiguities of metaphorical connections between ourselves and the world rather than remaining only within the categorical abstractions that separate us from the world." (p. 112, Briggs & Peat, 1999).

Chaos theory call attention to the self-similarity of patterns in various complex dynamical systems' functioning and to the creative response to change, which together provide a conceptual rationale for the use of metaphors through the discovery of the fractality of attractors. Metaphors allow us to explore the space between the usual ways that each of us understands our world. For example, we usually think that the space between 1 and 2 as 1. However, thinking fractally we soon realize that there is literally an infinite number of rational numbers between 1 and 2. Thus what is at one level a very simple account of the nature of a system can at the same time, at a more nuanced level, be infinitely complex. In human terms, we can use labels, prejudice and stereotypes to characterize individuals or we can seek to explore their complexity and their interconnectedness ultimately to everything else in the universe (Barabasi, 2003). If as counselors we opt for the latter strategy then metaphor (connecting similarities of apparently diverse entities) would be an almost inevitable counseling consequence through the self-similarity and interconnection of complex dynamical systems. Fractals are the patterned means by which we seek to understand the functioning of individuals as strange attractors. Metaphors provide one of the most useful and most creative counseling techniques for helping both client and counselor to traverse and elucidate the fractal in the process suggesting and indicating both the subtlety and the interconnectedness of each individual's life transitions and career.

13.7. The CTC suggests a change in emphasis in career counseling from prediction to pattern recognition

Chaos theory's ideas of "emergence" and "fractality" reorient the practice of traditional career counseling away from a focus on analysis and prediction toward pattern

identification and insight (Johnson, 2001). The CTC implies that it is foundational for counseling to look for the interconnections in each client's life, experience, aspirations and thinking. The CTC takes advantage of the self-organizing properties of complex systems to provide an alternative perspective on counseling. The role of the counselor is to assist the individual develop an appreciation of the emerging patterns (or themes) present in their strange attractor, while at the same time recognizing the potential for these patterns to reconfigure unpredictably and dramatically. Hence the individual develops wisdom (as outlined above) through insight into the meaning making process of discovering patterns in the complexity of their life transitions and career.

13.8. The CTC points to the limitations of plans and actions as strategies for career counseling

Formulating, committing to and pursuing goals has often been seen as a major component of career counseling (Greenhaus, Callanan, & Godschalk, 2001). Chaos theory suggests that such an approach may be effective in the short term but in the longer term goal setting tends to fail. Studies on the effectiveness of goal setting tend to provide support for this position (e.g. Tubbs, 1986). Goal setting is seen within the CTC as an attempt to impose a point attractor on reality, and thus simplify the world into a closed system. The reason goal setting is so much more effective in the laboratory is because the term 'laboratory' means the best attempt to produce a closed system where one can insulate participants from extraneous influences. Elite athletes are often put forward as good examples of the efficacy of goal setting. However, it is far from clear how selective such examples are, and furthermore such individuals tend to be somewhat shielded from the vagaries of life by a coterie of coaches and minders, in effect creating the closed system required for goal success.

Within the CTC framework, individuals are strange attractors and so the longer the timeframe of the goal, the greater the chance that the inherent unpredictability of the open system will undermine goal achievement. Generally most career-related goal setting has too long a time horizon for goal setting to be viable.

Characterizing goal setting as imposing a point attractor on reality highlights the tension between goal setting and opportunity awareness. There is no room for new opportunities in a closed system where the focus is so narrow. This is the problem of fitting people to jobs since it assumes static "pegs and holes" rather than dynamical participants creatively negotiating the frequently altering demands of 21st century working and the recursiveness of such interactions. The CTC highlights the need for continual active engagement and moves the emphases of career counseling—it calls for continual planning, rather than just plans and therefore transfers the stress of counseling from resolution to process; from the production of outcomes to the development of skills and from exclusive focus to perpetual flexibility.

14. Future directions

The realities of modern work have necessitated the introduction of a new vocabulary into career development thinking. Such terms include inter alia, spirituality, complexity, non-linearity, uncertainty, magic, metaphor, narrative, chance, systems, emergence and constructivism. To date no theory has effectively integrated such a range of ideas into a coherent framework. It is our contention that chaos theory does. Moreover when applied

specifically to career development and life transition, the Chaos Theory of Careers provides a new understanding of how such concepts interconnect and can provide further theoretical insights, research directions and counseling strategies.

In theoretical terms, the conceptualization of the attractors needs to be further refined and explored to yield more powerful applications of these concepts. The relationship between each of the closed system attractors and the strange attractor needs to be explored further. What (if any) are the transformation conditions governing how and when one attractor evolves or regresses to another form of attractor? How do attractors relate to traits and states? Is attractor thinking domain specific? That is, if you have a tendency to think in terms of the torus attractor in your career, do you think likewise in your home life? How can we measure the attractors more accurately? Can different forms of strange attractors be identified within or across people and what implications does this have for career behavior? Is there any variation in the tendency to be "stuck" within one attractor—that is, are we more or less likely to fall into thinking in terms of the point, pendulum, torus or strange attractor? What are the dynamics of the operation of different attractors within the one system (or individual) at the same time?

In addition the idea of "resonance" across systems as an explanation of uncertainty remains an intriguing possibility worthy of further consideration (Briggs & Peat, 1999). It may also provide insights into synchronicity—the hidden patterns and correspondences of the functionings of systems (Peat, 1987); and to synchronized chaos—the nonperiodic mutual influence of systems on one another (Strogatz, 2003).

If Barabasi (2003) is correct that the future of science is to be found in networks, then the interconnections and their formation and dissolution within and between attractors remains unexplored territory with potential for career development (Inkson, 2007).

In terms of research the ongoing formative and summative evaluations of chaos theory based counseling, require further work. In counseling we see the positive and negative effects of the concatenation of unplanned events which suggests the importance of finding out more about the impact of multiple chance events on individuals' life transitions.

Miller (1995) attempted to initiate a consideration of uncertainty in career development and Tien, Lin, and Chen (2005) report research on the dimensions of uncertainty. However, the concept remains insufficiently explored generally in the career development field and in particular from a chaos perspective in which it is pivotal. Given that human limitations in the face of complexity logically results in levels of uncertainty how does uncertainty influence individuals' career development strategies and decision making? How do different people respond to uncertainty? Which attractors are used, and under what circumstances, and with what kinds of decisions?

In terms of career counseling practice the Chaos Theory of Careers draws attention to the need for humility in counseling. We do not wish to denigrate the considerable skills of career counselors but when confronting complexity, change, chance and non-linearity the realistic limitations of all our endeavors also becomes obvious. We believe that insecure and ineffective career counselors will resort to closed systems thinking as a way to obtain outcomes and demonstrate control. Chaos-oriented counselors have no such "luxuries". They work collaboratively with their clients, amidst the ambiguities, ambivalences, the uncertainties and the general messiness of life transition reality. They have to confront the closed system thinking and expectations of their clients and attempt to move them from certainty to uncertainty (Peat, 2002). Initially this looks like losing ground, going backward, generating confusion—humility is a quality few of us seek and even fewer of

us understand and appreciate. The ways to do this as counselors as a means to client understanding and living in the strange attractor, continue to challenge us.

Further explication and application of the "career wisdom" concept counseling is also needed. How might the spiritual dimensions of the strange attractor be applied to life transitions? How do "complexity perception" strategies relate to dimensions of luck readiness for counselors and their clients?

The metaphor of the story has become a commonplace in career development (Inkson, 2007). How might archetypal narratives to provide insights into what it means to live on the edge of chaos? Booker (2004) argues there are seven basic plots in stories: Overcoming the monster; Rags to riches; The Quest; Voyage and Return; Comedy; Tragedy; and Rebirth. Each archetype may be useful in understanding the stories that clients tell us, and in recognizing the degree to which they are thinking in terms of closed or open systems. Locating a client story within an archetype may provide a powerful insight to guide clients to creative solutions to their problems within the relevant archetype.

Finally Amundson, Harris-Bowlsby, and Niles (2005) identified seven common career counseling myths. We have no disagreement with these, however for 21st century careers we would want to add the myths of certainty and control. Peck (1978) consciously echoing the Buddha, commences his famous book with "Life is difficult". With the recognition of the significance of complexity, change, chance and the connectivity of all existents, we are increasingly coming to realize how complicated reality is and how challenging our futures are going to be. However, challenge and difficulty are keys to growth and fulfillment. This paper has endeavored to illustrate that the Chaos Theory of Careers provides a perspective for being able to confront, adapt, create and accept the challenges, opportunities and the mysteries of life transition and career development, humbly, bravely, responsibly and hopefully.

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