The Chaos Theory of Careers in career education

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Approaches to career education in schools continue to be dominated by a focus on school to work or further or higher education transition planning. It is argued that as a consequence of this, the emphasis is on identifying relatively stable and singular vocational goals or outcomes. Furthermore the theories, techniques and models that support this focus characterise the world as largely stable and predictable. It is argued that these assumptions about the world and careers are increasingly questionable and this calls into question the theories and models used to support the short-term vision of transition. The Chaos Theory of Careers is introduced as a dynamical systems theory alternative and contemporary model of career development that emphasises continual, uncertain and non-linear change, complexity of influences, and emergent fractal patterns in career. The application of this approach to career education is adumbrated challenging traditional notions of career planning and goal setting, and highlighting the importance of creativity, re-invention and resilience as important outcomes of contemporary career education.

Introduction

The world in which today's students are being educated is characterised by continual change and increasing complexity. The inescapable reality of life in the 21st century is that change is being driven at ever greater speed by the forces of technological advances, globalisation and the rise of Asian economies (Pink, 2005). Work and careers are not immune from these global developments. The nature of work, the conditions of work, the place of work in people's lives, the security of work and the promise of work are all changing often in significant and far-reaching ways for both individuals and communities. Cherished notions of secure employment, a guarantee of a job, inexorably being able to climb the corporate ladder to the top, a position for life, or at least the foreseeable future, have been gradually eroded for both blue collar and more recently white collar occupations over the last 30 years (Pink, 2005).

Communications technology has developed to such an extent that world events, apparently infinite amounts of knowledge, and cultural differences, can be accessed, shared and understood almost as soon as they happen and are articulated from almost anywhere in the world. One of the results of this huge increase in real-time global connectivity has been to fundamentally alter the nature of the economic and political systems within which we work and live. The potential for real-time feedback or the promulgation of information through global networks has resulted in these systems resembling complex dynamical systems or chaotic systems where small changes in one part of the system can lead to disproportionately large changes elsewhere (and vice versa) and where it is increasingly difficult or impossible to make long range deterministic predictions about the behaviour of the system.

As Taleb (2007) points out:

> Look into your own existence. Count the significant events, the technological changes, and the inventions that have taken place in our environment since you were born and compare them to what was expected before their advent. How many of them came on schedule? Look into your own personal life, to your choice of profession say, or meeting your mate, your exile from your country of origin,

> the betrayals you faced, your sudden enrichment or impoverishment. How often did these things occur according to plan? (p. xix).

Contemporary challenges for career education

These new realities pose a significant challenge for careers education because these realities challenge many of the traditional and widely applied concepts such as the notion of 'fit' between a student's interests and an occupation (e.g. Parsons, (1909); Holland 1997)); and the effectiveness of a career plan and goal setting (e.g. Zunker, 2006). Career education has implicitly or explicitly been based on a rational process model, the product of which is a career transition plan. Typically these involve the steps of: knowing oneself; knowing about occupations; matching occupations to personal preferences; and setting goals to gain entry into the preferred occupation. Theories of person-environment fit or matching have been challenged in the last decade on a number of grounds (e.g., Amundson, (2003), (2005); Arnold, (2004); Bright, Pryor and Harpham, (2005); Patton and McMahon, (2006); Pryor and Bright, (2003a), (2000b), (2007); Savickas, (1997)). Arnold (2004) reports that the concept of fit and the way that it is measured may be inadequate, highlighting a series of studies showing that fit does not seem to predict important occupational outcomes like job satisfaction. Furthermore, the concept of fit in these theories is of a static match between a person and an occupation; however, it is questionable whether the assumption developed in the first half of the 20th century, that people and jobs do not change over time, is applicable in our 21st century interconnected world. Finally, the widespread adoption of these theories can lead to an over-reliance on interest inventories or other self-exploration activities running the risk of reducing career choice simply to a consideration of measured vocational interests and preferences.

These traditional approaches assume a future that is relatively stable and therefore knowable and predictable. Based on this assumption, traditional planning and goal setting activities make sense. However, it is increasingly questionable whether this assumption is a reasonable one. If the world of work into which students will move is itself moving and moving unpredictably, how do these traditional planning and goal setting processes equip our students to handle change, chance and uncertainty with dexterity, optimism, poise and resilience? Is an over-reliance on goal setting viable in a world where the goal posts move continuously? How useful is a plan in a world where, as Taleb (2007) has observed, 'when I ask people to name three recently implemented technologies that most impact our world today, they usually propose the computer, the Internet and the laser. All three were unplanned, unpredicted and unappreciated' (p. 135).

How do traditional career planning processes equip students with the skills to reinvent themselves to meet changing labour market demands, or to spot opportunities to change the labour market with new products and services, or to re-establish themselves after a career reversal? Savickas and Baker (2005) point out,

> With less stable personalities and occupations, vocational psychology's basic model of person environment fit with its goal of congruence seems less useful and less possible in today's labor market (p. 49).

In short, are we equipping students with the skills to handle ongoing career change, chance and complexity? How would career education look if it were based on more dynamic models of career based upon change, chance and complexity?

The Chaos Theory of Careers

The Chaos Theory of Careers (CTC) (e.g. Pryor & Bright, (2003a), (2003b), (2011); Bright and Pryor, (2005), (2007), (2011a)) was developed to address the perceived shortcomings in traditional approaches, including:

1. Failure to incorporate the range of potential influences on people's careers; 2. Failure to move beyond a narrow sense of matching to the dynamic, interactive and adaptive nature of human functioning in the world and in making career decisions and taking career action; 3. Failure to go beyond acknowledging to incorporating into theory the tendency of humans to

construe and construct experiences and perceptions into meaningful and often unique interpretive structures for understanding themselves, their life experience and their world; 4. Failure to adequately conceptualize unplanned and unpredictable events and experiences which are often crucial and sometimes determinative in the narrative of people's careers. (Pryor and Bright, 2011a, pp. 6-7)

The CTC characterises people and the environments in which they live as complex dynamical open systems. They are complex because they are subject to many different influences. For instance, in career terms, Bright, Pryor, Wilkenfeld and Earl (2005) reported that students' career choices were influenced by parents, geography, friends, teachers, the internet, the media more broadly, politicians, sporting stars and many other factors. This is consistent with the emphasis on a range of career influences identified by Vondracek, Lerner and Schulenberg (1986), Patton and McMahon (2006). The systems are dynamical and open because they are constantly moving and interacting within themselves and with their environments. These systems exhibit certain characteristics including: complexity; non-linearity; change; chance; emergence; and fractals.

Complexity

Complexity refers to the sheer number of different influences that bear upon people and their careers. For instance, Pryor and Bright list 22 influences that students acknowledge in their career decision-making behaviour (Pryor and Bright, 2011a). Pryor and Bright (2006), (2011) illustrate this point using a parable of puppies and ping pong balls. A career trajectory is like a trajectory of a ping pong ball released into a room containing a litter of playful puppies, some strong cooling fans, and an open window. The trajectory will be influenced by all of these other agents and in ways that rapidly make it impossible to predict precisely where the ball will go. As more influences are considered, the possible number of interactions and outcomes rises exponentially and virtually incalculably. For such reasons, it is simply not possible to make long range deterministic predictions about career paths. It challenges us to encourage students to appreciate the complexity in their lives and to understand that 'keeping things simple' may risk over-simplifying things.

Non-linearity

Another feature of these systems is often referred to as non- linearity, or colloquially as the 'Butterfly effect'. This refers to the famous observation of the chaos theorist and meteorologist Edward Lorenz, that tiny changes in the initial conditions of chaotic systems can result in disproportionate changes in the behaviour of the system over time (and vice versa). This is why, Lorenz argues, we cannot make long range precise weather forecasts, because we can never be precisely sure what the initial conditions of the weather pattern were (e.g. Lorenz, 1993). In the same way, we do not know what the initial conditions of our own systems were, and approximating or taking educated guesses is not going to help, given that sensitivity to tiny changes in initial conditions can change everything. The implication of this is two-fold. Firstly, it challenges the viability of a long term career plan because things may change out of all recognition. Secondly, it demands that we prepare students to expect and be able to handle, to the best of their abilities, unplanned non-linear events in their careers and lives.

Continuous change and chance

It should be obvious that chaotic and complex systems are characterised by continuous change and unpredictable events that are likely to be experienced as chance events. There is now an increasing body of empirical evidence pointing to the centrality and ubiquity of chance events in careers (e.g. Bright, Pryor and Harpham, (2005); Pryor and Bright, (2011a); Hirschi (2010); Krumboltz, (1998); Betsworth and Hanson, (1996); Hart, Rayner and Christensen, (1971); Roe and Baruch, (1967); Williams, Soeprapto, Like, Touradji, Hess and Hill, (1998)). Despite this evidence, chance events are still not well enough acknowledged in career development programs, and often their presence in career development results in a fatalistic and distorted perception of their nature. Bright, Pryor, Chan and Rijanto (2009) demonstrated that people tend to be biased in their recall of chance events, recalling those that were negative, severe and relatively uncontrollable far more than positive and controllable events. In other words, when we think of chance events in careers, we tend to think of dramatic set-backs like being injured in a motor vehicle accident and being unable to work, rather than meeting somebody at a social event who offers us a job. The challenge

for career education is to incorporate chance events more centrally into programs, and to emphasise their often positive impact along with strategies to increase luck readiness (Neault, 2002) or opportunity awareness (Pryor and Bright, 2011).

Emergence

Emergence is a feature of chaotic systems that is often overlooked in simplistic treatments of the chaos theory. For example, the CTC is not synonymous with Happenstance Learning Theory (Krumboltz, 2011) although both emphasise unplanned or chance events. CTC also emphasises the emergent order that arises from the complex interplay of the systems' elements both endogenously and exogenously. Over time complex dynamical systems display a form of emergent order – a distinct pattern that is self-similar while also continually changing, and susceptible to phase shift in which the structure and functioning of the system may radically alter. This seemingly paradoxical notion is captured in the concept of a 'fractal' which is a graphical representation of the trajectory of the system.

Fractals

The fractal patterns of most complex dynamical systems are best understood and interpreted by standing back (taking a longer-term perspective or viewpoint) and looking at them as they emerge in all their complexity. Focusing only on one small part of the pattern is likely to be misleading and unrepresentative of the pattern as a whole. Further, relying on the shape of the pattern at one time, does not provide a guarantee it will look the same at a later time. The challenge for career education is to develop methods to assist students in seeing and exploring the fractal patterns (the self-similar but changing patterns) in their lives and careers. This means moving away from linear notions of career paths and timelines and acknowledging and embracing 'messier' more complex and non-linear patterns of life and career. Indeed Bright (2003, p. 20) has described typical career paths as not a straight, ever-upward line, but rather a 'drunken man's stagger through the world of work'.

Challenges for contemporary career education

The CTC challenges traditional career education on a number of different points. In particular, it de-emphasises the importance of being committed to a precise goal or objective, and emphasises the importance of the development of skills to understand complex patterns in their complexity, to understand the nature of change and chance, and the importance of teaching students skills of re-invention, change and resilience. The aim therefore, is to equip students with the skills to meet these new challenges in the 21st century. Some of the implications of the CTC for career development programs were set out in the Shiftwork model (Bright and Pryor, 2008) where 11 essential shifts in career development practice were identified. Shiftwork was defined as 'assisting clients to reinvent themselves continually, to identify opportunities, to recover from setbacks, to find meaningful work that matters to them and to others, and to capitalize on chance' (ibid.).

From plans to plans and planning

Of most immediate relevance to career education was the shift from plans to plans and planning. The emphasis currently in many career education programs is on the outcome, goal or the production of a career transition plan (e.g. Howell and Frese, 1982). However despite their ubiquity, evidence that those with a plan are more 'successful' (whatever that means) than those without, is surprisingly thin on the ground and can conflate measures of expectation or ambition with a career plan. What is lacking in career education is an emphasis on ongoing planning. Typically, students are taken through a series of exploration and goal setting activities to reach a plan. However, there are a series of meta-skills that we term 'Planfulness' that are equally as important to teach. Planfulness refers to the ability to (among other things): devise, revise, abandon, pause, re-launch, finesse, adapt and copy plans. In other words, teaching students not only the fundamentals of a plan, but also how to deploy plans to maximum effect. Thus what is being argued is not an abandonment of career plans, but rather a much

stronger emphasis on the process of continually planning in a changing and unpredictable world.

Currently, the usual acknowledgement of the need for contingency planning goes no further than injunctions to develop a 'Plan B'. However this merely reflects further static thinking, and fails to appreciate that the reasons that Plan A failed may also preclude Plan B from succeeding. The recent disaster at the Fukushima nuclear plant in Japan is a cautionary tale about backup plans failing spectacularly as people were overwhelmed literally and figuratively by a tsunami. In business schools, they often teach an example from the early 1970s. The Dutch oil company Royal Shell deliberately trained their staff at management meetings in how to develop plans by getting them to explore different scenarios. For instance, they explored what could go wrong in their business by developing very detailed scenarios. This benefitted them immensely when they confronted the 1973 oil crisis, because their managers were better able to think on their feet and develop successful plans to navigate through the troubles. The result was that Shell emerged as one of the stronger oil companies and rose to greater market dominance. Similar scenario planning exercises covering a range of different outcomes, including extreme and left-field events, help students to practice their planning skills and to develop a mindset of adaptability as well as an awareness of the changing and unpredictable environment they are moving into.

Teaching creativity

A second major implication of the CTC approach is that students will benefit from being taught how to boost their personal creativity enabling them to be proactive in a changing and uncertain world. Amundson (2003) observed that people with career problems often report being 'stuck', something he characterises as a crisis of imagination. In other words the person, for whatever reason, feels unable to generate creative solutions to their career dilemma. Career education can learn a lot from studies of creativity and teaching students how to think about their careers in creative ways. For instance, teaching students how to creatively combine different transferable skills to increase their options in the marketplace, or to be able to offer a new product or service is likely to be an increasingly valuable life skill.

Recognising parental influence

Finally, the complexity of influences on students' careers has been shown to be disproportionately influenced by parents. Bright *et al.* (2005) surveyed 651 university and high school students, asking them detailed questions about their occupational preferences, their choices of course, and questions about sources of influence including parents, teachers and friends. Using the data set collected for this study, further evidence of the influence of parents is presented below. Figures 1 and 2 show that students who reported no influence of their parents in career choice were just as likely to select an Investigative (Scientific) career, as they were an Enterprising (Commercial) career. However, the pattern is very different for students reporting the presence of parental influence. These students are significantly more likely to select an Enterprising career over an Investigative career. The pattern is consistent across Paternal and Maternal influence. The mean Holland code (scored 1 = Realistic to 6 = Conventional) was significantly closer to the Enterprising category for both Maternal and Paternal influence ($F=5.55$, $P<0.05$ mothers, and $F=4.95$, $P<0.05$ fathers).

This data could be interpreted to suggest that parents encourage their children to seek work in Business rather than Science. One can speculate as to the reasons for this; however, it seems plausible to suggest that it could reflect a greater personal understanding of commerce careers than science careers, and perhaps also a perception that commerce careers are somehow more attractive. Whatever the reasons may be, educating parents about the new career realities is an essential component of career education. Furthermore, harnessing appropriately trained parents to support career education efforts as 'career helpers' in the classroom, may be a viable strategy to enhance and expand the career education possibilities for both students and parents.

Figure 1:

Comparing students' occupational preferences reporting no influence of father vs students reporting a father's influence in career choice

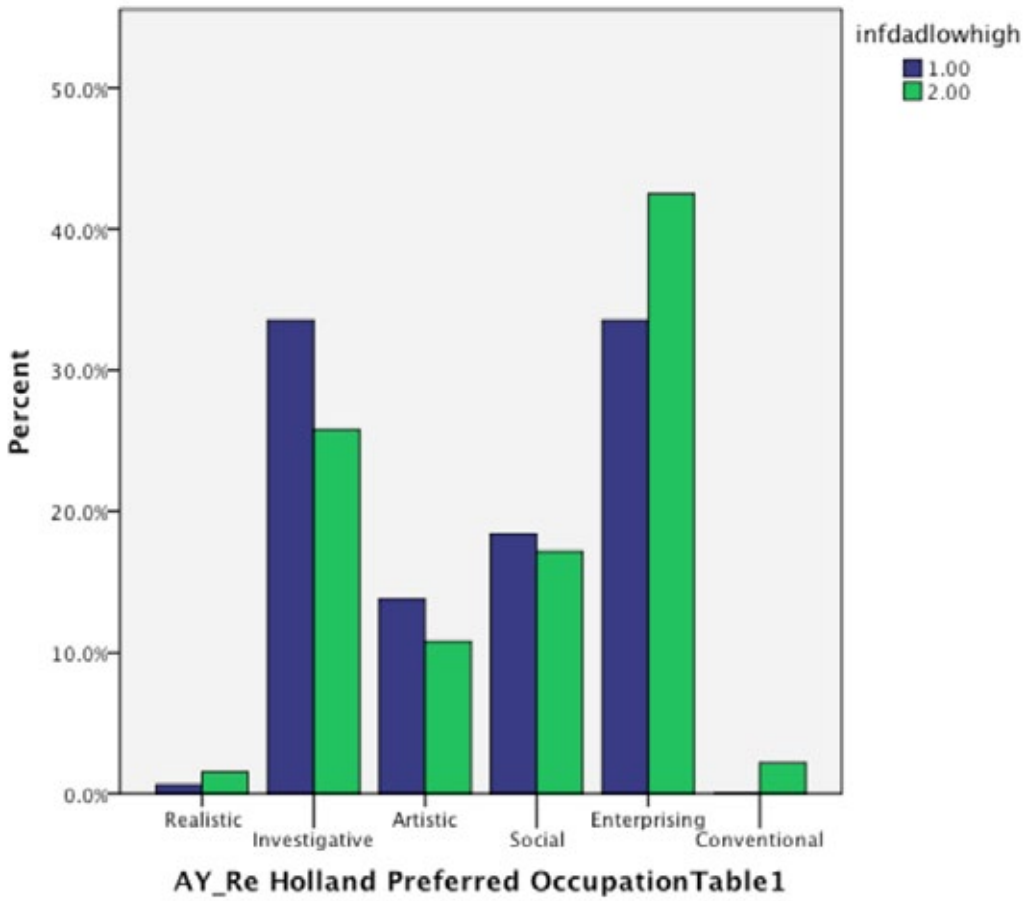
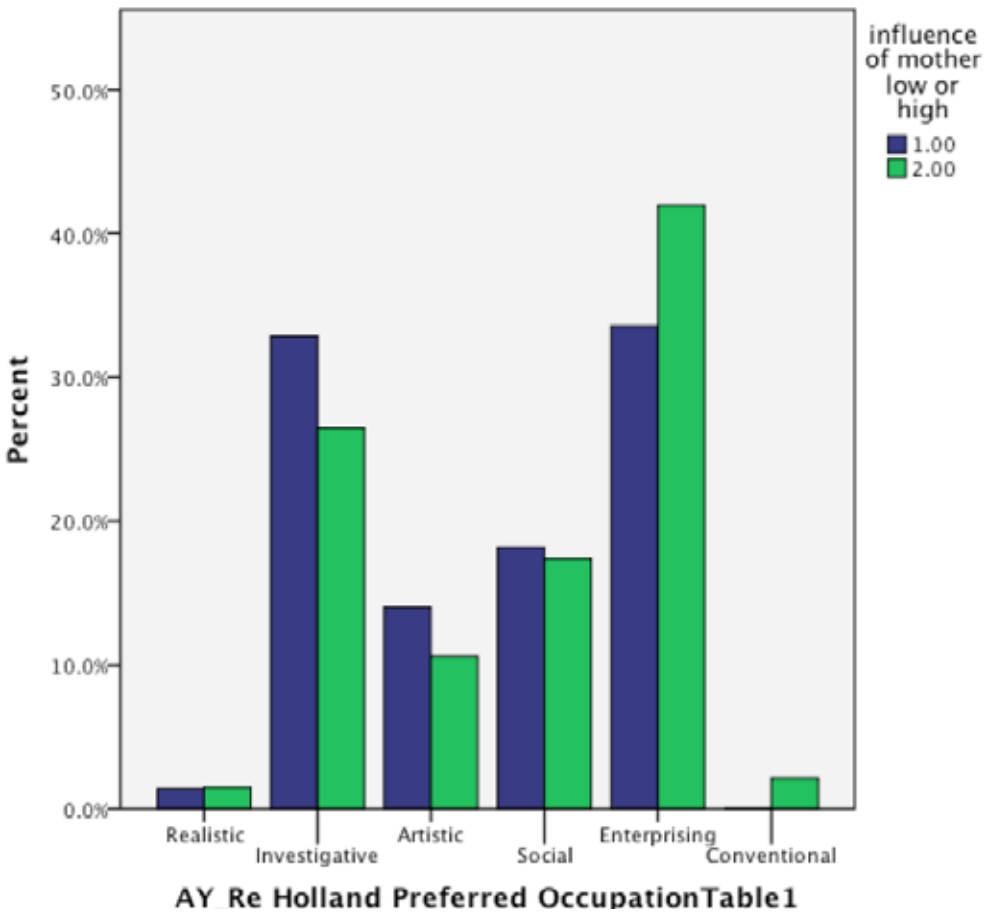


Figure 2:

Comparing students' occupational preferences reporting no influence of mother vs students reporting a mother's influence in career choice



Developing adaptability and resilience

Implicit in the chaos theory analysis of complex dynamical systems are notions of human limitations in terms of knowledge and control over individuals' own lives and the environments in which they may choose to work. Such limitations inevitably lead to not only an acknowledgement of the possibility of failure but an acceptance of its virtual inevitability (Omerod, (2005); Pryor and Bright, (2011b)). Such considerations point to the importance of adaptability and resilience in light of the continuous experience of failure rather than a belief that failure implies unworthiness, recklessness or stupidity. Of course it may, but the challenge for career education is to be able to prepare students to be able to function constructively in a working world in which they will encounter failure and in which they will fail themselves.

Harford (2011) outlined three general aims and five principles for adaptability in a world in which failure is the norm rather than the exception. The general aims were:

1. Keep trying new things while recognising that at least some of them will fail;
2. Make failure survivable so that you still have enough resources to try something else;
3. Ensure that you know when you have failed since it is easy to fool yourself that things will get better and that only a few more resources or time will turn things around.

In light of these general aims, Harford (2011) provides five guiding principles for adaptability which could form the basis of a constructive process-orientated career education programme. These principles are:

1. Be prepared for and ready to accept failure;
2. Experiment and try lots of different possibilities and seek out new ideas in the process – the way to have a good idea is to have lots of ideas;
3. Recognise failure, learn what you can from it and move on;
4. Limit the impact of failure so that no one failure prevents you from pursuing other possibilities;
5. Learn and repeat the process in an ongoing way – the changing world will not stop changing simply because you finally made a successful decision.

The emphasis needs to be moved away from failure as disaster to failure as strategy for dealing with a world that is complex, dynamical and sensitively interconnected. However, this is not intended as an agenda to encourage failure and it would be naïve to think that failure is a pleasant experience. Most people, most of the time, want to be successful – we want to achieve our goals and that is why we formulate them; albeit as doubtful as much goal setting necessarily is. However when we experience failure, we need resilience to be able to rebound with renewed effort rather than spiral into despair and self-pity. Siebert (2005) describes resilient people as,

> …those who consciously decide that somehow, some way, they will do the very best they can to survive, cope and make things turn out well. (p.9)

Siebert goes on to outline a programme for building five resiliency skills which could also be incorporated into career education curricula. The five skills are:

1. Optimise your health and well-being;
2. Develop effective problem solving skills including being analytical, creative and practical;
3. Develop 'strong inner gatekeepers'; by which he means positive self-esteem, self-confidence and a self-concept based in moral standards and values;
4. Develop high skills of self-management, curiosity, self-initiated learning and optimism;
5. Discover talents for serendipity; this is similar to the luck readiness dimensions outlined by Pryor and Bright (2005). Siebert describes this as '…the ability to convert accidents and misfortune into lucky accidents and good fortune' (ibid., p. 12).

Some examples of the application of the CTC to career education

CTC approaches are increasingly being used in educational settings. In Canada, Simon Fraser University Career and Volunteer Services use the CTC framework and Luck Readiness Index (a psychometric instrument developed to measure Opportunity Awareness). In the United States, Florida State University, University of Kentucky and Vanderbilt University all teach and/or use the CTC framework and tools in the career education of students. In Australia, several schools and an education department have applied the CTC framework to career education initiatives, and one of the authors has worked with community groups on developing effective parental career helper programs tied to the CTC approach.

One of the challenges in implementing CTC approaches in career education is to overcome the perception that it is a complex and difficult model for students to appreciate. However, Borg, Bright and Pryor (2006) describe how they introduced a 'Butterfly model' of career development based on the CTC in a school in New South Wales. The model depicts a figure of eight rotated ninety degrees. The left hand loop represents planning activities and the right hand loop represents unplanned events. The model also resembles the butterfly pattern generated by Edward Lorenz's meteorological chaos equations. The purpose of the model is to illustrate the close links between planned events and unplanned events and how these mutually interact. Figure 3 illustrates this model. Figure 4 illustrates the model populated with a career example. The introduction of the model was positively received by students, parents and senior staff within the school. It proved to be an effective way of introducing the notion of unplanned change and its

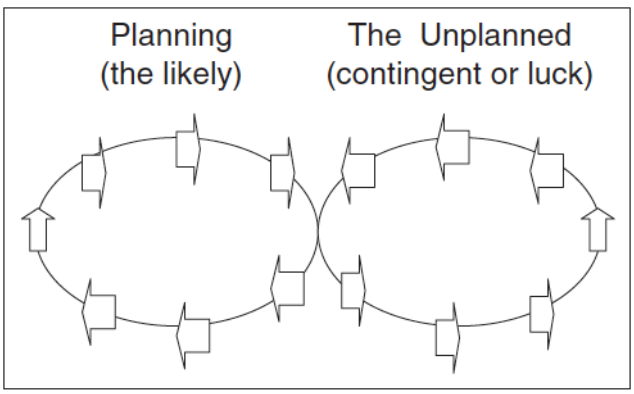


Figure 3: The butterfly model of Careers as used in High Schools

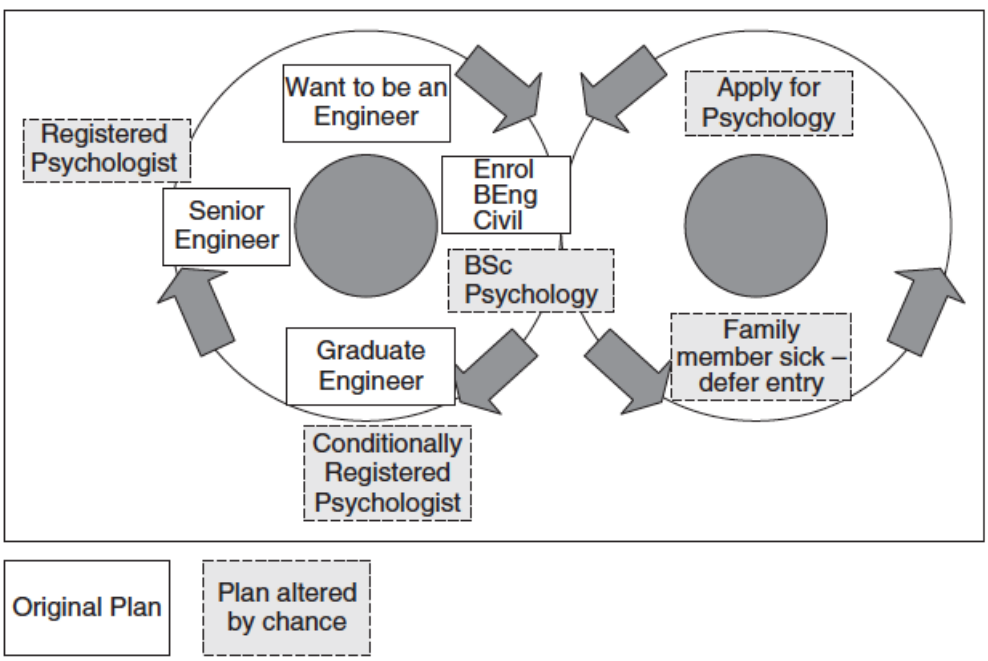


Figure 4: A 'worked' butterfly

inevitability into careers education classes.

Loader (2009, 2011) outlines a career development program based on the CTC introduced at a school in Victoria, Australia. The first lesson introduces the CTC by showing a Youtube video 'Where will you be' (Bright, 2010) that highlights some of the key ideas of the CTC. This is followed by further video presentations of chaos concepts, such as non-linearity, using clips from the films Sliding Doors and The Butterfly Effect. Lesson Two, starts with a recap and then allows students to share their own 'what if' stories about their lives to date. They then complete a Butterfly model for themselves. In Lesson Three, the students complete a Career Collage based on their lives right now and then a second collage based on their lives in 10 years time. They are then asked to consider the themes that emerge from the collages and to write a short summary of them.

The collage exercise, although not new to careers work, can be more powerfully interpreted within the CTC, as a way of considering the emergent and non-linear patterns of a person's life. Collage places no emphasis on students arranging the narrative along linear lines, and often patterns emerge from the interaction of collage elements that are more telling than the sum of the individual components. Thus, collage is a powerful way to holistically capture aspects of a person's emergent patterns. In the final class, students are introduced to the Luck Readiness Index and the Exploring Reality Chaos Checklist – two online inventories developed for use with the CTC framework. This allows a discussion about openness and opportunity awareness – two key concepts in the CTC. Loader's work further highlights the practical possibilities of implementing the CTC in a school environment with positive results.

More recently, one of the authors has been working with a state Department of Education on the development of a school career planning workbook based upon the Beyond Personal Mastery® model of creativity (Bright, 2009). This process model, which was developed from the CTC framework, is designed to teach people how to think creatively in adapting themselves to new situations or how to make the most of opportunities with creative solutions. The pilot workbook for this project encourages students to make creative links between their transferable skills and to develop new insights and experiences. Some of the activities involve designing and inventing new jobs. The aim of the planning book is encourage students to take a multi-dimensional view of themselves and to become adept in making the links between opportunities and their skill-sets.

Finally, in an initiative entitled the Parents as Career Helpers Community Project, parents are given training in the realities of change, chance and complexity, and the need for openness to experience and lifelong learning. These volunteer parents are then involved in a community evening where they hold career conversations with local students, following a semi-structured interview process. This process overcomes one of the biggest problems facing careers educators; namely, that they have insufficient resources to conduct one-on-one career interventions with students. For many students, these sessions are the first time they have had the opportunity to discuss their career thoughts in a focussed and relatively private way. Furthermore, the project provides a good opportunity to engage the parent body and to communicate modern ideas about careers within the CTC framework. The results of this project have been encouraging with positive feedback from students, parent volunteers and the parents of the students. In addition, in one of the schools in which this was run, the volunteer parents have spread their involvement to other career initiatives such as site visits and establishing employer-school relationships that have led to tangible employment outcomes.

Conclusions

Career education programs in schools and other institutions can benefit from a shift away from a focus on a singular plan, goal or vocational outcome, to a more holistic, process-oriented approach that recognises the realities of change, chance and complexity in the modern careers world. The Chaos Theory of Careers is a purpose-designed theoretical framework supported by empirical evidence that emphasises these concepts. In this paper, we have tried to show how some of the cornerstone ideas in CTC provide challenges for traditional career education programs; and finally, we have attempted to illustrate examples of the practical implementation of the CTC

in educational settings to demonstrate its practical as well as theoretical worth. The results to date are promising, however there is much more that can be done and needs to be done to harness the full potential of the CTC in career education.

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