

Chapter Three

Introduction

In Chapter Three I will present a conceptual overview of chaos and chaos theory from a variety of perspectives and illustrate through the literature and discussion how aspects of chaos and chaos theory, while not the same, intersect and connect to one another across disciplines over time from premodern to modern times. The perspectives of chaos for review will include: classical, technical, artistic and humanist. The survey of the literature will present ideas for us to think about to gain an understanding of chaos theory and consider its contribution and possible application to managing change and influencing the creativity within successful planning. From my perspective chaos and chaos theory are effective when considered as positive, strategic and integral parts of change and the creative process.

Part One: Chaos, a classical perspective

In the review of chaos from a classical perspective we will review premodern chaos over time and across cultural boundaries. To determine the time periods for review I looked at the etymology of chaos, chaos theory and Chaos presented in the OED and decided that this etymology presented chaos beginning in 1425. But as there are references to the Greek and Latin, or classical roots of the term in the OED, I needed to look at chaos from ancient times to now and across cultures. Fortunately, my literature search revealed the 1995 article by Michael Butz, “*Chaos theory, philosophically old, scientifically new*”. For this survey of chaos over time I follow the time periods used by Butz in his survey article. Chaos theory and chaos will be presented and explored in:

Ancient civilization including Asian, Egyptian, Babylonian, Native American [Indigenous American], and Greek civilizations; Christian cosmology; aberrations since Christianity; cosmological convergence; and Poincare, beyond the renaissance man (1854-1912).

James Hite Jr.'s 1999, monograph *Learning in Chaos* also provides a brief history of chaos and chaos theory from the classical and technical perspective. Hite corroborates some of the key ideas and concepts expressed by Butz, and he reminds us that it is important to understand that chaos and chaos theory, although related, are not one and the same. He suggests that as we consider the implications related to chaos in our modern world organizations—school, work and life-- we need to look beyond the concepts of classical chaos. According to Hite:

It is important to go beyond that concept and view the changes themselves as part of the systems in which we live and participate. As such, it is important to understand how technical chaos manifests itself within our organizational systems. We need to see how we can recognize it and how we might manipulate it to the greater success of the systems. We need to understand the role that learning might play in helping us, our machines and our networks participate more effectively in a technically chaotic system.

(Hite, 1999 p. 54)

He expresses new ideas relating chaos to learning for the purpose of enabling us to be more effective and for aiding in our search for connection with humanity in the modern world. In my view Hite makes the connection between chaos as part of creativity and how learning can embrace chaos so that we can be more effective.

William Demastes', 1998 monograph *Theater of Chaos Beyond Absurdism, into Orderly Disorder* presents yet another perspective on chaos in premodern cultures, corroborating the perspectives presented by Butz and Hite, and looking forward to modern cultures to challenge us to think across disciplines. He too references our need and search for interconnectedness as part of our humanity in modern times. I concur with Demastes' ideas related to thinking across disciplines.

Butz begins his survey article stating that his intent is to portray for the reader a philosophical history about the concept of chaos that to his knowledge has not been told so far by chaos theorists. He does not claim expertise as a historian or as a philosopher; he explores the ideas of chaos in terms of its psychological meaning. I have selected this article for its breadth, conceptual mapping of chaos and chaos theory over time and its references. I trust you will find this overview thought provoking and recommend his survey article as it presents ideas about chaos from a broad variety of perspectives and (as always) the references are really interesting reading!

*Value of
history
and
breadth
of
cultures*

Ancient civilizations and chaos

Asian civilization

In ancient civilizations holistic existence that is nonlinear was understood as an integral part of these civilizations. Butz reports that the: “Chinese symbol of Yin and Yang predates Greek civilization by at least 2,000 years. The Tao symbol was developed... during 2598-2698 B.C.” (Butz, 1995, p.2)

The essence of the Tao symbol emphasized the central role of opposites and their powerful influence on one another. From the writing of Lao Tzu, Tat Te Ching, Tao is thought not to be constant or predictable but as chaotically fluid. In Chinese cosmology chaos is revealed through the Tao process and “the chaos is the seed of creation.” (Butz, 1995, p.3)

There are more recent examples in Buddhist philosophy. The integration of opposites is integral to holistic thinking and this implies chaos is part of holistic thinking processes. In the Buddhist writings chaos is referred to as orderly. The meaning presented is that chaos is

orderly, because it comes in a pattern; it is chaos, because it is confusing to work with that order.” (Trungpa, 1991, in Butz (1995) According to Butz the concept of wholeness and implicate order (Bohm, 1980) are commonplace in the cosmology of Asian people.
(Butz, 1995, p.3)

Egyptian civilization

Egyptian cosmology presents a different although similar use of the concept of chaos in its creation myth. Chaos is in the Pyramid Texts written by Heliopolitan priests in approximately 2500 B.C.. Butz refers to interpretative text by Guirand, (1965) somewhat exclusively because in his survey of Egyptian mythology he found it to be the clearest. Chaos is presented conceptually as

“chaotic waste” , “chaotic waters”, during creation coming from the Egyptians “having witnessed the apparently miraculous way in which as the floodwaters subside, the pools they leave behind soon swarm with animal life.
(Butz, 1995, p.3)

Butz observes that in both of these ancient civilizations chaos is presented in their mythologies in terms of fluidity, frequently associated with water. Historically both the Asian and Egyptian cosmologic reference is thought to have occurred at around the same time, ca. 2500 B.C..

Babylonian civilization

The Babylonian creation myth dates back to the time of Hammurabi 2000 B.C. (according to Butz who cites Jung, 1967 and Pritchard, 1950.) In the account that Jung presents there are initially three characters:

Tiamat, mother of the gods who “created everything,” Apsu, the progenitor of the gods, and Ea, son of the watery depth of wisdom that has conquered giant snakes and dragons to destroy him, [Ea].
(Butz, 1995, p.4)

The myth discussed by other scholars and in Briggs and Peat (1989), Tiamat is equated to the concept of chaos, (creation of everything) and Briggs and Peat pointed out that with Tiamat’s destruction, a new order is created by Marduk, one of the Gods.

Butz, synthesizing his survey of these three ancient civilizations, confirms that we have the concept of chaos existing in three ancient cultures.

Indigenous American civilization

According to Butz,

Many of the Native [Indigenous] American peoples on this continent have an equally nonlinear and chaotic understanding of the world in their philosophy, similar to the three cosmologies discussed earlier. [Butz acknowledges that] It is difficult, though, to indicate this in a scholarly fashion, because the Native American people by necessity have translated their history and belief systems in an oral fashion.
(Butz, 1995, p.4)

The manuscript of Chichicastenango is generally regarded as the oldest book of the Americas. It was translated into Latin from the oral traditions of its historical roots in the mid-16th century. Scholars postulate that at this point translations may have been influenced by the Christian missionaries in that time. There is ambiguity surrounding the history of this text, but Butz,

notes that scholars argue that the text reflects the cosmology of the Quiche Indian culture at that period. Again looking at the creation myth, the idea of chaos does precede the creation of forms. Butz believes that this is a tenuous conclusion. He however, notes that the type of tradition seems to be a continuation of the “chaos-order sequence”.

(Butz,1995, p.5)

It is interesting and timely to observe that the Indigenous people of North America also share an understanding of the world in their philosophy that is holistic and rooted in nonlinearity. The holistic perspective from Indigenous people is something in 2018 we are only beginning to acknowledge, explore and coming to understand. In 2018 I participated in a “blanket exercise” that was led by Indigenous Elders at Dalhousie University in Halifax, Nova Scotia. The exercise interwove historical facts and anecdotes to tell the story of the colonization of the Indigenous peoples of Canada, by Europeans. Reflecting on the exercise I see how important it is to be informed and am optimistic that we are ready to acknowledge Canada’s and our

Indigenes past history, planning for an inclusive society and working collaboratively to build our future together in Canada.

Greek civilization

Verily first of all did Chaos come into being, and then broad-bosomed Gaea, a first seat of all things for ever... Out of Chaos, Erebus and black Night came into being...

(Butz, 1995, p. 5) referring to Kirk & Raven, 1957.

The quotation above is Hesiod's description of chaos from Theogony and may be familiar since Greek cosmology is generally thought to be the underpinning from which modern Western civilization began. The description of creation Hesiod proposed was written in 7th century B.C.. This is the standard citation in European-influenced scholarship. Butz

reports that there is another figure in Greek history – Heraclitus of Ephesus, who is now primarily known for his idea concerning the underlying unity of opposites and the essential tension between them.

(Butz, 1995, p.5)

Christian cosmology

In Butz's review he notes that Christianity arose at the same time as Greek cosmology and that scholars suggest that likely the Christian creation myth was adapted from the Babylonian creation myth. The Babylonian myth dates from approximately 200 B.C.; the Christian myth found in Genesis dates to 500 A.D.; with Christianity beginning between (B.C. and A.D.)

Christianity in Europe is thought to be largely responsible for the pervasive rationalistic attitude of the West in contemporary society. Following from this perspective chaos is bad and order is good.

(Butz, 1995, p.6)

In contemporary society we seek order and interpret disorderly ideas based on order in our world view. Butz refers to Descartes, (17th century rationalism) and notes that with the rise of Christianity the Western worldview is "intolerant of contradiction to the idea of "good", unless one is able to find a rationalistic explanation." (Butz, 1995, p.7).

Butz concludes that both cosmologies, Greek and Christian, had a considerable influence on modern thought. He suggests that this may have been "why it continues to be difficult for Euro-Americans to see chaos in any positive sense at all." (Butz, 1995, p.6).

Butz reflects that chaos theory may present us—Western culture-- with an opportunity necessary for growth. He suggests that perhaps we can now step back and view chaos from both a scientific and a philosophical perspective, dispelling fear of chaos in its literal form. This is a strong point of view and one I share.

Aberrations since Christianity

Scholars, including philosophers, scientists and others in various disciplines, have attempted to explain chaos and nonlinear forms in a philosophical scientific context. These have included the Alchemists (1500 -1700 A.D.), Kant (1724-1804), and Hegel (1770-1831) all who parted ways with the separation that proceeded from Christianity. According to Butz, “all had ideas that are now encapsulated in one shape or another, philosophically or scientifically, in the new science of chaos theory.” (Butz, 1995, p.7).

The thinking and ideas of these scholars will be explored in the review of chaos theory across the disciplines, later in this chapter.

Convergence of theories of the universe

One of Butz's findings is that in each of the cosmologic perspectives presented previously there is a period of chaos that is preceded by a new form or order. Butz refers to this as the "chaos-order sequence". (Butz, 1995, p.5)

The Chaos Strategies Planning Process will address chaos and facilitate creation of a new organizational order. Using it to map a complex current environment will reveal chaos in the analysis of the transition and or transformation factors and theoretically the mapping process will be useful to see a way through the chaos as in the "chaos-order sequence" and create a new complex organizational environment as a "projected chaos sphere".

In tracing of the history of chaos and chaos theory Hite notes that

chaos is an elemental part of human existence, wired in from the beginning through the archetype of the anima. [Jungian Psychology equates anima with soul. It is the magic that makes us believe incredible things and that life may be lived.] It is a primitive concept that humans cannot self-generate. It is built-in, and it surfaces spontaneously.

(Hite, 1999, p.70)

Both Butz and Hite present the perspective that chaos is an inherent spontaneous part of our cosmologies, and that these cosmologies continue to influence modern thought.

Thinking about Butz's reference to the chaos-order sequence I suggest that Hite's perspective is insightful as he goes a step further from Butz and articulates a connection between chaos and learning. Hite clarifies

that chaos exists as an archetype and that learning, closely tied to experience, is a way through which we cope with chaos. It is the pattern of wisdom that ultimately surfaces to aid us in our struggle to make sense of the anima. Experience and wisdom can be viewed as the integrating forces between chaos and order.

(Hite, 1999, p.72)

Hite sees chaos as elemental to our human existence and explains that through learning and experience we cope or manage our path through chaos. I think his ideas are insightful. Consider that we all solve problems, create new ideas and set a path forward to renew constructing our future. This is our human chaos with a future perspective. Hite makes an exciting and critical connection between chaos and learning derived from his view of our elemental human existence, which in turn

supports my rationale for why this study is relevant and important in the context of libraries supporting learning.

Demastes thought-provoking preface to *Theatre of chaos* alludes to similar ideas expressed by Butz and Hite. Specifically, Demastes states that in

premodern cultures, chaos was often seen as the soup of energy out of which change, creativity, and hope have sprung.
(Demastes, 1998, p. XII)

The ideas expressed by Butz, Hite and Demastes converge and challenge us to reconsider our perspective on chaos and consider it more holistically, which was a perspective adopted by some, but not all premodern cultures presented in the review of chaos over time. The review presents how chaos is reflected across cultures and recurs from ancient times to now. The survey of chaos over time has been very revealing and certainly influenced my thinking to encompass chaos from a broader perspective.

The recurrence of chaos intrigues and fascinates us and which was evident in the exhibit *Mystical Landscapes from Vincent Van Gogh to Emily Carr*, curated by the Art Gallery Ontario, 2017. In the exhibit catalogue, Peter G. Martin (2017) said the following about the scope of the exhibit and its presentation related to the fascination with chaos and cosmos:

In the nineteenth and early twentieth centuries it was becoming understood that the observable universe was much larger in in space and in time than had been imagined; but it was not infinite; matter was seen not to be eternal and union with nature was presented within an evidence-based framework.

Martin, (2017), p.273

Part Two: Chaos a modern technical perspective

The review of chaos from a modern technical perspective will include ideas from both chaos and chaos theory in the art of how they naturally intersect. The technical perspective will include the modern physical sciences and mathematics, and the social sciences incorporating business, education and information management.

Poincaré, the European connection

From Butz we learn that in the early 1900s, Henri Poincaré was part of the Intuitionist movement in France that viewed science as an artistic effort. He is known for his work in dynamical systems theory; specifically he worked on solving two-body and three-body cosmological problems. He in fact did not solve the three-body cosmological problems and in his address to the Societé de Psychologe (Butz, p.8 from Koestler 1964) he discussed how this solution rose out of nowhere.

A very small cause which escapes our notice determines a considerable effect that we cannot fail to see. Prediction becomes impossible, and we have the fortuitous phenomenon. (Butz, 1995, p.7) citing (Poincaré in Crutchfield et al., 1986, p.48)

Poincaré's work revealed that

the three-body problem can only be approximated, solving the problem with probabilities that estimate a planet's position. (Butz, 1995, p.8)

As a result, in “modern” science the importance of nonlinearity was demonstrated through his work in the early 1900s.

Poincaré provides a European connection to the survey of chaos of the past in the science of modernity. Poincaré's non-linear and artistic perspectives, as Butz observes, brings us close conceptually to Lorenz's discovery of the butterfly effect (1963). We will discuss Lorenz's work in greater detail later in this chapter.

Chaos necessary for balance and connection

In reflecting on his purpose for writing this survey article, Butz states that

continuous reference is made to the Greek idea of chaos.
Second, it seems that Christians disdain chaos. ... [Butz]
contends that in certain cases it has not been safe to study or
event consider certain ideas because of the Euro-Christian
ethic—such as Galileo’s plight. It has been a powerful
political influence pushing along the idea of order, linearity,
and other similar ideas that equate to “good” at all costs.
(Butz , 1995, p.9)

Butz notes “even scientists like Hawking (1988) avoid its [chaos’s] inquiry [or the Euro-Christian ethic’s].” (Butz, 1995, p. 9).

Butz reminds us of James Yorke’s (1975) use of the term chaos to describe nonlinear phenomena and suggests that “fortunately, for the Euro-American mind, chaos now comes neatly wrapped in a nice rational scientific package.” (Butz, 1995, p.9).

Butz is well aware that his survey article considers chaos across civilizations at the most abstract level and he believes it is important to include the historical-political ramifications of embracing or avoiding chaos so that we can consider it as an opportunity for growth.

Chaos across subject disciplines

The review of chaos across subject disciplines will be a “journey” that will present ideas about chaos and chaos theory in a variety of subject disciplines in the 20th and early 21st centuries. The journey will meander, as journey’s do--around disciplines and through decades to highlight ideas and promote discussion. As Shipengrover reminds us: “chaos teaches that there are no prefixed, definitely describable destinations and that we do not know what is going to matter until we are into the journey.” Shipengrover, 1996, p.2).

I selected subject disciplines drawing on my professional experience, education and my reading of the literature. Chaos and chaos theory will be presented and explored broadly across the following disciplines:

The Physical sciences, including mathematics; the Social sciences, including business, education, information management and libraries; the Arts, including Fine Arts (Fashion, Visual Arts and Music) Literature, Theatre; and the Humanities perspective.

Chaos theory in physical sciences including mathematics

Butz presents chaos theory from a scientific and mathematical perspective buttressed with a philosophical foundation;

Chaos theory, like many other theories in physical science, was derived from a largely Western or Euro-American viewpoint. The emphasis of “science” during the past century

has largely been to explain complex systems in the simplest manner possible through linear models. In the past, nonlinear, “chaotic” types of equations or systems were mostly avoided. With the popularization of chaos theory, Western scientists, and I posit the Western culture, have been asked to come to grips with the nonlinear and chaotic aspects of their existence. Other cultures outside of the European tradition of the west, have historically valued the nonlinear and chaotic realm of existence that lie beyond the control of science or culture. Chaos theory reintroduces the philosophical roots of chaos to our Western science and culture. Although these ideas may seem to be new scientifically, and new in the western philosophical tradition, they are in fact not new at all.

(Butz, 1995, p. 2)

Butz’s perspective challenges us to think about chaos and chaos theory broadly, to consider nonlinearity in terms of chaotic systems, and of understand our existence from a philosophical point of view.

In the 1960s and 1970s chaos theory was an area of study and inquiry In the physical sciences including mathematics. *The New science of chaos.* (Gleick, 2008, p.43) was a term coined by James Gleick (2008).

But unpredictability was not the reason physicists and mathematicians began taking pendulums seriously again in the sixties and seventies. Unpredictability was the only attention-grabber. Those studying chaotic dynamics discovered that the disorderly behavior of simple systems acted as a creative process. It generated complexity: richly organized patterns, sometimes stable and sometimes unstable, sometimes finite and sometimes infinite, but always with the fascination of living things.

(Gleick, 2008, p. 43)

Gleick provides an account of the work of Edward Lorenz, who is credited with discovering the “ Butterfly Effect”. Edward Lorenz, as a young boy, enjoyed the study of weather, and he had been a weather bug, keeping tabs on the max-min on the thermometer while playing with mathematical puzzles growing up at his parent’s home in West Hartford, Connecticut. He studied mathematics at Dartmouth College, graduating in 1938 and thought mathematics was his calling. WWII intervened and he was assigned the task of weather forecaster for the US Army Air Corps. After the War he took his interest in mathematics and meteorology to begin his work at MIT. In the 1960s meteorologists and “serious” scientists mistrusted computers. Meteorology is about forecasting and mathematics which was Lorenz’s passion. Lorenz worked tenaciously, fascinated by weather phenomena and

With the aid of his primitive computer, Lorenz had boiled weather down to the barest skeleton. Yet, line by line, the winds and temperatures in Lorenz's printouts seemed to behave in a recognizable earthly way. They matched his cherished intuition about the weather, his sense that it repeated itself, displaying familiar patterns over time, pressure rising and falling, the airstream swinging north and south. He discovered that when a line went from high to low without a bump, a double bump would come next, and he said, "that's the kind of rule a forecaster could use" But the repetitions were never quite exact. There was pattern, with disturbances. An orderly disorder.

(Gleick, 2008, p.15)

Lorenz's work continued and in the winter of 1961 he was at a watershed moment. He was working to examine a sequence at greater length, and as his story goes,

he set the computer to task to re-create a sequence and headed off to get a coffee. When he returned the results of the computer produced something unexpected, something that planted a seed for a new science. ... "The Butterfly Effect was the reason."

(Gleick, 2008, p. 16,20)

Lorenz' discovery was an accident, or serendipity merely lead him to a place he had been all along. Lorenz defined the Butterfly Effect simply as “an image of predictability giving way to pure randomness.” (Gleick, 2008, p.22).

Computer modelling related to the study and research of weather continued at MIT and Reading, England. Weather forecasting was just the beginning of using computers to model complex systems. Gleick reports that; “Computer modelling had indeed succeeded in changing the weather business from an art to a science.” (Gleick, 2008, p.20).

As Lorenz continued his research the Butterfly Effect acquired a technical name: sensitive dependence on initial conditions. This thinking has a place in folklore and in science. The research community

were astonished that Lorenz had mimicked both aperiodicity and sensitive dependence on initial conditions in his toy version of the weather: twelve equations, calculated over and over again with ruthless mechanical efficiency. How could such richness, such unpredictability—such chaos—arise from a simple deterministic system?

(Gleick, 2008, p. 23)

In 2010, chaos theory continues to be of interest. Étienne Ghys shares the following commentary on the work of Lorenz in his research paper presented at the *Poincaré Seminar 2010* in France; Ghys, Étienne, “The Lorenz Attractor, a Paradigm for Chaos.” (Chaos, 2010, p.1-54)

it is very unusual for a mathematical or physical idea to disseminate into the society at large. An interesting example is chaos theory, popularized by Lorenz’s butterfly effect: “does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” A tiny cause can generate big consequences! This is a generally known and accepted fact.

(Ghys, 2010, p.6)

In this article Ghys sets out to sketch some of the main concepts of chaos theory and put it in the context of how we see it today. Ghys states that:

the close observation of the Lorenz attractor does not suffice to understand all the mechanisms of deterministic chaos, but it is an unavoidable task for this aim. This task is also quite pleasant, since this object is beautiful, both from the mathematical and aesthetic points of view. It is not surprising that the “butterfly effect” is one of the few mathematical concepts widely known among non-scientists.

(Ghys, 2010, p.1)

Ghys also understands that chaos is often described from a negative point of view.

He challenges this perspective as he sees that with chaos there is both a positive and a negative aspect which in his view work together. Ghys states that:

Chaos theory is often described from a negative viewpoint: the high sensitivity to initial conditions makes it impossible to practically determine the future evolution of a system, because these initial conditions are never known with total precision. Yet, the theory would be rather poor if it was limited to this absence of determinism and did not encompass any deductive aspect. On the contrary, I want to insist on the fact that, by asking the good questions, the theory is able to provide rich and nontrivial information, and leads to a real understanding of the dynamics.

(Ghys, 2010, p.3)

Ghys explains that within the context of chaos theory the concept of sensitive dependence on initial conditions is part of the mechanics of deterministic chaos.

Ghys considers “the butterfly as a nice gift from physicists to mathematicians.”

(Ghys, 2010, p.3).

Chaos theory in the social sciences

In the Social Sciences there is a plethora of literature on organizational management and organizational behavior. For this review I would like to draw your attention to literature that references chaos theories and change management in learning organizations and educational institutions. Beginning with an editorial written by Peter A.C. Smith—"implications of complexity and chaos theories for organizations that learn". Smith's editorial provides a summative account based on the experience of his 2003 consultation with The Canadian Imperial Bank of Commerce (CIBC). "It was established at CIBC that change could be successfully facilitated through blended application of theory such as system dynamics, and the then emerging notions of 'chaos and complexity'" (Smith, 2003, p.321).

While the all-encompassing aspects related to chaos theory and complexity were understood within the organization, in reflecting back Smith shares that throughout the consultation process the "impact of non-rational people-factors, e.g., emotion, trust, openness, spirituality were underestimated. " (Smith, 2003, p.321).

Smith reminds us that the uptake of new ideas, modes of exploration and adoption of these new ideas are dependent on management mindsets. His experience reveals that management mindsets impact every aspect – implicit or explicit-- of what people actually think and do. He cautions that the process of creating the new state of change, the desired new environment envisaged in chaos and complexity while maintaining stability, is one of the most important functions of the newly defined management roles. I agree with Smith's findings to some degree and suggest that the

uptake of new ideas, and adoption of new ideas is dependent on the mindsets of all members of the relevant organization in all roles, not only management as he suggests. The Chaos Strategies Planning Process attempts to address these and other change factors with the identification of intrinsic and extrinsic transformation factors.

Looking at the literature related to chaos and chaos theory and education broadly I discussed the writings of Shipengrover, Murphy, Mossberg, and Richey earlier in Chapter 1. Now I am looking at the literature specifically related to organizational change within the context of education and am sharing an interesting article for your consideration by Terence J. Sullivan published in 2004. Sullivan makes the case for using multiple system theories to describe organizational change in an education context. He discusses the viability of complex systems theory, evolutionary theory and chaos theory as metaphors for providing a viable context to give a global perspective within an educational setting. He presents a rationale for “using chaos theory as part of a much larger theory of evolution and complexity.” (Sullivan, 2004, p.43).

In his view, chaos theory is useful as part of an emergent phase of decision-making and change management. He notes that “at some point in people’s individual and organizational learning, a certain global understanding of the complexity leads people to appreciate their place in their global network.” (Sullivan, 2004, p.53).

In Education, the theme of globalization related to chaos, is also addressed by Mossberg, who provides a prescription for global leadership to which chaos is integral and she argues that

the new science of chaos mandates a view of institutions and of the role of leadership that is profoundly optimistic—and even, in the classic meaning of the work, comic.

(Mossberg, 1993, p.5)

She suggests learning to understand chaos will provide a lens to visualize problems, situations, and strategies, specifically about the nature and role of organizational leadership in dealing with change and diversity.

(Mossberg, 1993, p.50)

Mossberg refers to chaos as an oxymoron. Let's think about this in terms of our current environment based on her analysis: demographics are changing, cultures are becoming more diverse and migratory, technology makes us truly global, and interconnections are no longer optional. In other words, we are increasingly interdependent, joining different cultures with different views on how things should be done and why, which means conflict has increased while at the same time we have grown closer, have greater access to different views than ever before, and thus more potential to reduce conflict than ever before. In thinking about our global world and society today as reported in the new media, we are seeing more unpredictable conflict. In times of organizational change there is evidence of increases in incidents

of lateral violence. “Lateral violence is a worldwide occurrence and is a learned behavior as a result of colonialism and patriarchal methods of governing and developing a society.” (Native Women’s Association of Canada, Lateral violence fact sheet, 2015, p.1). Lateral violence can be manifested in many ways and the root cause is the nature of the imbalance in power relationships that can exist in organizations or groups. “When a powerful oppressor has directed oppression against a group for a period of time, members of the oppressed group feel powerless to fight back and they eventually turn their anger against each other.” (Native Women’s Association of Canada, Lateral Violence Fact Sheet, 2015, p.1).

Mossberg continues her argument stating that chaos isn’t chaos. Rather, chaos is an expression of infinitely complex order. Chaos (the theory) is founded on an accumulation of evidence that chaotic-looking behaviours may be manifesting order in patterns visible only from a distance of time or space. Chaos sees movement, growth and change as orderly processes of things becoming different over space and time.

(Mossberg, 1993, p.50)

Mossberg is suggesting Chaos has a sense of patterned order that is viewable from a distance and this matches my concept of considering the view from the clouds at 30,000’ to inform one’s thinking and planning. This high level view provides breadth to take in the big picture in a holistic manner.

In, the field of Public Relations Priscilla Cottone outlines how the discipline is evolving to address the traditional scientific world view and encompass a broader perspective for the process of critical research. This process involves exploration of key questions stemming from the new science of chaos. She argues that the new science of chaos opens up to incorporate multidisciplinary perspectives and is informed by information that traditional science omits. Interestingly enough she begins her article reflecting on the work of Thomas Kuhn:

When Kuhn (1962/1970) first suggested that science does not progress smoothly, adding one block of knowledge to the next, but rather grows in sudden spurts, in revolutions often fomented by individuals who live in academic crevices of interdisciplinary thought, he created what he predicted—a revolution in science. Thirty Years ago Kuhn’s ideas were considered radical, outside the mainstream. Today Kuhn is acknowledged as one of a number of scholars who opened the door to a re(dis)covery of the art and poetry of science.
(Cottone,1993, p.168)

Kuhn’s vision and clarity for observing simple truths from a peripheral view continues to be acknowledged as foundational for forward thinking ideas that are

relevant today. From my perspective Kuhn’s writing, now half a century old, resonates today for his thinking about the “art and poetry of science“.

Chaos theory in business literature

Tom Peters authored *Thriving on Chaos* a key monograph in the business literature in 1987. The book is about how we must change – revolutionize our thinking to manage in the future, and it was quite extraordinary in 1987. In my role as an education librarian, in the 1980s, this was one of the most sought out publications.

In the Preface, Peters shares his “great debate” and how he arrived at the title *Thriving on Chaos*.

The book is about a revolution in thinking and Peters was adamant about “revolution”. The great debate was about the choice of a preposition: “amidst” or “on”. The competitive situation was chaotic—so “chaos“ was easy. And it’s not hard to sign up for “thriving.” He landed on using the preposition “on” as this was in his view more proactive and being proactive would be key in the revolution for the future. Winners of tomorrow would need to deal proactively with chaos.

(Peters, 1987 p.xi, xii)

Peter Senge's 1990 monograph: *The Fifth Discipline: the art and practice of the learning organization* presents an elegant description of the "Shift of Mind". (Senge, 1990, p.68) that he sees is required to learn, and solve problems in our complex, cyclical and changing world. He is an advocate for adopting a linear *and* a non-linear approach to learning and solving problems as required. He refers to this as "seeing interrelationships rather than linear cause-effect chains, and seeing processes of change rather than snapshots." (Senge, 1990, p.73).

Moving forward to 2010, the business environment continues to be dynamic and in continuous change. This is evident in the literature where authors continue to probe and be inquisitive about chaos theory in relation to change in information and knowledge management settings. For example, Peter Smith writes about the knowledge lifecycle, stating; "The lifecycle consists of four stages: creation, mobilization, diffusion, and commoditization. It is the first state, knowledge creation which has the most direct implication for the role of chaos theory in knowledge management theory." (Smith, 2010, p.118).

Smith suggests chaos theory provides a new orientation that focusses more on a process rather than a structural systems approach when solving problems in an knowledge management environment, states that: "The role of the knowledge manager should therefore be to embrace chaos to facilitate knowledge creation." (Smith, 2010, p.120).

Smith cites Google and Pixar as two companies that have successfully embraced this approach for knowledge creation. Adopting chaos theory as an approach to problem solving fosters broad communication including lateral and vertical communication. Working in environments with a high degree of ambiguity requires leaders to communicate widely and this contributes positivity to the organization and as a result knowledge creation thrives.

Connecting classical and technical perspectives on chaos

Citing Peters, Hite identifies three themes that relate to organizational thinking in the 1990s: a global world is now the perspective for many organizations; more flexibility is needed in the marketplace; and continuous innovation is a given. Hite states that with these three themes in mind: “That is— excellent firms of tomorrow will cherish impermanence—and thrive on chaos.” (Hite, 1999, p. 73)

Hite reminds us that in the classical sense, chaos is neither totally good nor totally evil. It is something we accept as part of history. In modern organizations we seek to understand how systems operate, evolve, manage change and continuously reinvent themselves. Part of our purpose is to understand change, but also to improve to enhance success in the midst of change. Chaos is not something we want in successful enterprise activities. It is accepted in the classical sense. Hite suggests that “to accept chaos as an operating reality might be possible if we understand how the chaos itself operates. This in his view brings us to technical chaos and the acceptance of chaotic activity in organizational systems.” (Hite, 1999, p.74).

Hite declares that in his view technical chaos begins with organizational theory. He uses the term technical chaos as a way to distinguish mathematical, scientific, or theoretical chaos from the form of chaos we have described and reviewed as a classical perspective. Broadly speaking I concur and note that Butz references Poincaré, in his survey of chaos over time,

it seems that in chaos circles, Poincare, the father of dynamical systems theory is known chiefly for two ideas. First, he is known for solving the three-body problem (or not solving it, actually). Second Poincaré has become known through his address to the Société de Psychologie, in which he discussed his creative act of Fuchsian problems and how the solution arose out of nowhere.

(Butz, 1995, p.8)

Butz elaborates stating that Poincaré viewed science as an artistic effort. This is where I see technical chaos beginning as this is where Butz begins the discussion of science, physics, mathematics and philosophy related to modern European thought. (Butz., 1995, p7) It is really interesting to take note of Poincaré for making the connection between science and art in relation to chaos. This is a thought I will consider later in my reflections and discussion about how ideas and theories of chaos begin to converge.

I recently read Michael Harris' (2017) *Solitude A singular Life in a Crowded World*.

He discusses some of what he learned from visiting the Cognitive Science of Thought Laboratory at UBC where he went to find out if daydreaming matters. Cognitive science research at UBC is exploring “undirected thought processes” shop talk for daydreaming and mind wandering.

(Harris, 2017, p.46)

Harris explains this as “the brain doing intensive work where the conscious mind is unaware of this work so thoughts emerge without our anticipation or understanding. They emerge from the blue.

(Harris, 2017, p.49)

Similarly, Kalina Christoff's (UBC) “new vision of a well-tuned mind included an interplay between concentration and stream of consciousness. Over-exercise one or the other and you impair the functioning of the whole apparatus.” (Harris, 2017, p.51)

She sees “solitude as a pathway connecting the analytical mind with the wandering mind.” (Harris, 2017, p.51) and states that daydreaming is an inherently creative process. From my perspective I understand the connection between daydreaming and creativity and by extension see this as connected to chaos. Is chaos part of our creative process? Is this what was implied in the OED chaos definition 5: “The natural or preferred environment of a person or thing; element; abode.” (OED.) In

my view chaos is part of the creative process and perhaps this was the implication in the OED chaos definition 5. The challenge is how to conceptualize or think about chaos and use it constructively and creatively for problem-solving.

Part Three: Chaos an artistic perspective

My review of chaos and chaos theory from an artistic perspective is approached from a personal perspective. Here I am sharing several ideas and concepts that I see as related broadly to chaos; these ideas and concepts were gained through personal experiences and reflection in the arts and in the literature.

Chaos in the fine arts

I begin with observations from my recent visit to the Royal Ontario Museum for the Christian Dior exhibit. The exhibit was all about fashion design, the society in which Dior created his designs in Paris and our more local Toronto scene where a few were fortunate to wear his creative fashions. The exhibit was a rich archive of fashions, patterns, fabric colour swatches, film footage, and design drawings. It is fortunate that these archival gems have been preserved and cared for over the decades. This speaks to the critical inherent value of libraries and archives in our changing world. The exhibit portrayed visual and cultural detail that revealed Dior's creativity and addressed change in Parisian society during his tenure in Paris. Dior's designs epitomized femininity and celebrated the female form. Through the exhibit I learned fashion design techniques changed radically with Dior's work as he creatively worked with fabric to provide comfort and grace with flowing lines. Prior to Dior

fashion was structured and very tailored to minimize the need for fabric: Europe was recovering from WWII and resources such as fabric were limited. Dior opened design and fashion to ideas about balance, form, colour, graceful lines and flowing fabric. In my view through, design Dior inspired women and men to recover from the chaos of wartime and to enjoy glamour in their lives through fashion.

Chaos theory in theatre

The world of theatre presents many ideas, reflections and learning. The plays of Tom Stoppard, for example, are eclectic. He drew from the world of science, philosophy, chaos theory and much more. John Fleming states that, “Cumulatively, Stoppard’s work has been concerned with the social moral, metaphysical and personal condition of being human in an uncertain world”. (Fleming, 2001, p.1-2) Fleming’s synthesis of Stoppard’s plays is timely and relevant for our changing world today. We learn from Fleming that Stoppard, having read the work of James Gleick, *Chaos: The Making of a New Science*, knew he could use chaos theory for the foundation of a new play; *Arcadia*. Fleming provides a detailed analysis relating *Arcadia* to chaos theory in many aspects of the play, including the setting with scenes alternating between time periods, the 1800s and today, and the characters’ discussion of chaos theory is part of the plot in both time periods. In the past, Thomasina theorizes ideas on chaos; in the present, Valentine educates the characters and audience about chaos. Fleming sums up *Arcadia*, as a work that dramatizes “Stoppard’s world view of life’s being comprised of a complex, dynamic interaction of randomness, determinism and metaphysics.” (Fleming, 2001, p.207)

Chaos theory in visual arts

The visual arts provide us one kind of opportunity to reflect back on ourselves and our humanity. This can be challenging, provocative, and inspiring all in relation to our own reality. Thinking about visual arts, Philip Glass states that “the rate of change in the visual arts world was far, far quicker than could ever happen in the music world. The world of painting expected innovation and new ideas.” (Glass, 2015, p.80).

Ocean Wave, influenced my thinking and reflection over time as it was part of my daily environment. (Hodgson, 1988). Momentum of the waves, the depth of colour, the layered brush strokes, served to evoke chaos in my sphere. The painting was a source of inspiration, energy and renewal for my persona.

Chaos in music

Music can be a pathway forward, leading us through chaos into a new realm. I share two reflections, one from personal experience and one from a novel, that provide heartfelt context about how we emerge from chaos and move forward with creativity and positivity:

Several summers ago, (July 2015) I attended the Tanglewood Summer Music Festival and heard a moving performance by the Young Artists Orchestra. The play bill included; Aaron Copland’s, *Suite from Appalachia Spring* and Edward Elgar’s *Enigma Variations*, Op.36. The performance was wonderful and the emerging artists were inspiring to hear. They clearly enjoyed performing their music. As a prelude to the program the conductor, Ankush Kuman Bahl, shared a reflection about the power

of music. He told us that he was studying conducting in New York City at the time of the 9/11 attack. He recounted that after that tragic day audiences came in droves and packed the concert halls across New York City. He shared that research studies tracking attendance have confirmed his reflection. The power of music performance brought people together as way of seeing through the tragic events of 9/11.

The Cellist of Sarajevo, written by Steven Galloway is a story of war and the destruction it creates, but also of recovery and renewal in the face of the chaos of war. One man, a musician sets out to play his cello:

And so today, like every other day in recent memory, the cellist sits beside the window of his second-floor apartment and plays until he feels his hope return.

(Galloway, 2008, p.xvi)

*Creativity
and
convergence
of many
disciplines*

Thinking about chaos theory in relation to music reminds me of the concept of strange attractors which is one of the foundations and central assumptions of chaos theory. Strange attractors flow and connect yet, appear to wander continuously and unpredictably. The theory tells us that the wandering is within context referred to as a “bounded range” in Chaos theory. In musical terms this is similar to improvising on a familiar melody. These reflections highlight the power of music and this is how I find my pathway through chaos and make sense of reality in times of tumultuous change. Music leads the way for me to come to terms with and view the world with a new perspective.

Part Four: Chaos, the humanities perspective

Reflecting back to move forward

The following is a series of quotations reflecting on the writing of Simone de

Beauvoir:

“The knowledge gained from humanistic research is considered to be the cornerstone of well-functioning democracies.”

(Pettersen & Bjornsos, 2015, p.1)

In today’s world, where religious fanaticism and totalitarian ideologies are gaining ground, continuous discussions of the human-made religious, social, and cultural expressions in the humanities are more relevant than ever. Moreover, when the inequality in wealth and resources is continuing to increase, we hold that the focus of the humanities on human beings and their worldly lives is highly imperative.

(Pettersen & Bjornsos, 2015, p.3)

Beauvoir’s inter- and cross-disciplinary approach is a model for the development and renewal of the humanistic disciplines in contemporary society, and there is much to gain by studying her novel method as a contribution to the advancement of the humanities today.

(Pettersen & Bjornsos, 2015, p.5)

Humanistic research and study teach us not to forget experiences and knowledge of the past, but to reflect upon them and use our collective memory to better address the needs of today's society. For example, to enable citizens to actively participate in the continuous effort to build and defend democracy, key humanistic methods such as critical analysis and interpretation are required. In contributing to the education of today's and tomorrow's citizens, the humanities need to interact with society. This is another example of where Beauvoir's work and life offer an excellent model. Her thinking—rooted in humanistic traditions and at the same time inspired by the ethical and political questions of her time—aims at concrete action and engagement.

(Pettersen & Bjornos, 2015, p.6)

I present these quotations and reflective perspectives in a sequence as they inspire us to think holistically and encourage dialogue, engagement, and discussion to foster action in contemporary times. I believe there is value in reflecting back to move forward and Simone de Beauvoir's writings from the mid-20th century provide a reflective and meaningful lens while continuing to be relevant as they are discussed by 21st century scholars for their insight into the contemporary world. When I read these passages I breathe and see the big picture where we are an engaged inclusive community, working collaboratively, using evidence and research strategies to

address our needs for creating a better world for generations to come. This is an opportunity to consider the Chaos Strategics Planning Process as a way of mapping the current environment and looking at intrinsic and extrinsic transformation factors to project a probable future environment. This is the how the Chaos Strategics Planning Process is intended to work at 30,000' with an eye to planning and moving forward to the future. Essentially we are responsible to influence and create the future world environment we want. We are in charge of our destiny, however "chaotic" the times may be. Or, perhaps we are in charge of our destiny because chaos is both path and destination for human being.