ON THE BLESSINGS THAT CHAOS BRINGS: A CLOSER LOOK AT CONFLICT THROUGH THE LENS OF CHAOS THEORY

Shalom Charles Malka
Sullivan University

Abstract

This paper's main argument is that chaos and conflict serve the vital mutual purpose of awakening motivating forces that rattle the status quo. We explore chaos theory's central assertion that disorder is a prerequisite for system renewal, and that chaos propels systems to higher levels of complex functioning through self-organization. We argue that the notion of transformation being proposed by several theories of conflict follows in the same vein. At the core of such theories is the belief that conflict creates the necessary tension that facilitates the process of unfreezing from a current state that one seeks to change. And, that introducing instability in stable lasting conflicts jolts the system, and releases motivation for change. We focus primarily on two conflict theories – conflict dynamic systems perspective, and on constructive controversy theory. Both assert that creating deliberate conceptual conflict results in disequilibrium and raises uncertainty about the correctness of a position and its rationale. Being a necessary condition that leads to novel solutions, the argument is that self-renewing organizations deliberately creates some degree of chaos and conflict through internal shocks that question mainstream assumptions and beliefs, thereby introducing a sense of perceived instability that ultimately leads to change. This paper explores parallels between chaos theory and several conflict models; we propose key properties that each approach shares to a varying degree with theory of chaos. In doing so, we focus on chaotic and conflict states, and the way they can be leveraged for producing positive outcomes for individuals and organizations. We conclude with a set of recommendations and practical implications for the management of chaos and conflict states.

Introduction

This paper views chaos and conflict as two distinctive but intertwined constructs that carry seeds for change. A state of chaos is likely to trigger conflict, while conflict may contain some degree of chaos. And, both offer opportunities for change by challenging the status quo and facilitating innovation (Coleman, 2014; Marcus, 2014). Events surrounding COVID-19 can serve as an example in support of this view. The pandemic brought about much chaos and conflict in its path, throwing the global economy into a state of chaos and introducing disruption and conflict into the working of governments, companies, and families (Lin & Xiao, 2020, April 24). Yet, the unfolding pandemic also created a sense of urgency for change and innovation (Remuzzi and Remuzzi, 2020). A few manifestations of such a change are the enhanced coordination between governmental bodies for delivery of large scale testing, the innovative approaches adopted by

pharma companies in search for a cure, and the collaboration between private and public sectors for the manufacturing of respirators (Forero & Perez, 2020, April 24).

Chaos theory suggests that when the organization is in the chaotic domain, new stabilities emerge that make a chaotic state a necessary ingredient for ensuring a continuous change and evolvement. Such a state encourages some degree of creative conflicts amongst the system's parts. Challenging and questioning current practices and processes is vital for change and renewal. This line of thinking is aligned with several theories of conflict such as the theory of constructive controversy (Johnson, Johnson & Tjosvold, 2014), and with conflict dynamic systems perspective (Coleman, 2014). The common assertion is that chaos and conflict serve the vital mutual purpose of awakening motivating forces that rattle the status quo. Indeed, chaos theory's notion that disorder is a prerequisite for system renewal, and that chaos propels systems to higher levels of complex functioning through self-organization, resembles the notion of transformation being proposed by those very theories of conflict.

For instance, conflict related approaches that are proposed by Marcus (2014) and Coleman (2014) appear to be congruent with this view. Applying Lewin's model of change, Marcus (2014) argues that conflict creates the necessary tension that facilitates the process of unfreezing from a current state that one seeks to change. This initial step is also aligned with Coleman's notion of introducing instability in long-lasting conflicts to jolt the system, and release motivation for change (Coleman, 2014). Further support for the notion of transformation through change is proposed by another conflict model - constructive controversy theory (Johnson, Johnson & Tjosvold, 2014). The theory finds merit in creating a deliberate conceptual conflict, resulting in disequilibrium, and raising uncertainty about the correctness of a position and its rationale as a necessary condition that leads to novel solutions, and to other related positive outcomes. In other words, a self-renewing organization deliberately creates some degree of chaos and conflict through internal shocks that question mainstream assumptions and beliefs, thereby introducing a sense of vulnerability and perceived instability that lead to change. And, while the need for stability is essential for a strategy to take root, jolting the organization periodically and for brief periods ensures necessary corrections for continuous evolvement.

Our paper explores parallels between chaos theory and several conflict models with a focus on chaotic and conflict states, and the way they can be leveraged for producing positive outcomes for individuals and organizations. Specifically, we offer a few observations concerning chaos theory's properties, as well as some insight on chaos, conflict, and renewal. In addition, we touch briefly on three conflict resolution approaches - conflict dynamic systems perspective, constructive controversy theory, and the problem solving-decision making model (PSDM) - and explore properties that each approach shares to a varying degree with theory of chaos. We conclude with a set of practical recommendations and implications for the management of chaos and conflict states.

Chaos Theory: Definition and Purpose

Chaos is a byproduct of turbulent environments characterized by turmoil and instability. Consider the turmoil generated by the COVID-19 pandemic and the chaos that ensued affecting governments' responses, supply chains, and disruptions of daily life as a vivid example. Chaos can also be the result of conflicting internal organizational dynamics such as the continuous tension between contradictory visions of management - rational and mechanistic, and unpredictable and disorderly. Reconciling these conflicting visions is essential given that some

management functions, exploitative in nature, like coordination and control seek order and stability, while other dynamic processes that are explorative in nature, such as individual initiative, experimentation, and innovation trigger disruption and drive the organization toward instability (Malka, 2020). The combined effect of these forces, whether internal or external, is likely to create complexity and lead to a chaotic state. Unless properly leveraged, such forces could be taxing to organizations, and particularly so in turbulent environments.

Under turbulent conditions, the empirical evidence suggests organizations that embraced chaos and complexity in their external environment and internal processes outperformed their competitors (Cvetek, 2008; Mason, 2009; Theodoridis & Bennison, 2009; Nguyen & Kock, 2011). One emerging conclusion is that traditional, bureaucratic, mechanistic management approaches may be suitable for stable environments, but they prove ineffective and failing in turbulent times. At the heart of such a failure is the fixation managers have with regularity, linearity, and predictability, and hence their difficulties in properly anticipating and managing unpredictable events.

Unlike the classical scientific focus on regularity and predictability, chaos theory focuses on randomness and unpredictability. In a sense, chaos theory strives for finding order in apparent disorder (Gleick, 2008; Lartey, 2020a). As such, chaos theory offers managers valuable insight on how to confront unpredictability in their environment and anticipate future challenges, thereby reducing the surprise factor of events in the external environment (Guastello, 2008; Haynes, 2007; Lartey, 2020a; Meek, 2010; Sanial, 2015).

Chaos theory is defined as "a qualitative study of unstable aperiodic behavior in deterministic non-linear dynamical systems" (Kellert, 1993). A system is dynamic if its behavior changes with time. Moreover, it is deterministic if the variables describing it relate to each other in a non-probable way. Thus, the theory focuses on non-linear systems that do not follow predictable and repeatable pathways. Such systems enjoy periods of relative stability disrupted by sudden change that triggers unexpected new patterns of behavior. This cycle is reminiscent of ideas proposed by Mintzberg in his seminal work on quantum theory of change (Mintzberg, 1987; Mintzberg & Waters, 1985). Being a key property of chaos theory, the notion of systems transformation from one state of dynamic change to another takes place through a bifurcation process, whereby long periods of stability are punctuated by short periods of instability that usher in necessary adjustments in organizations' strategy and operations.

Chaos Theory: Properties and Building Blocks

Organizations are exposed to forces of stability and forces of instability which push them toward potential chaos. Organizations in a chaotic domain are likely to exhibit the qualitative properties of chaotic systems. Several of these properties are depicted in Table 1. Key among them are dependence on initial conditions, bifurcation, strange attractors, and self-organization.

Initial conditions provide the impetus for activities and behavior of a system. Systems are sensitive to changes that occur in their initial conditions. Chaos theory asserts that slight changes in initial conditions may, through positive feedback, have a large effect on outcomes within an organization (Guastello, 2008). This process is also referred to as the Butterfly Effect following Lorenz seminal work on weather related forecasting (Lorenz, 1963). Lorenz, while analyzing weather patterns, discovered that small differences in weather's initial state could produce more severe weather conditions. This sensitivity to initial condition is a key attribute of chaos theory.

Initial conditions may encompass organizational structures, and processes, as well as relationships and behaviors amongst actors.

Table 1. Chaos Theory: Key Building Blocks.

Domain of Interaction	Scope of influence encompassing all possible behavioral consequences.
Initial Conditions	Initial state of both organization and actors at the start of a period of change.
Strange Attractors	Patterns of behavior of systems and actors.
Events and Choices	Internal and external incidents – planned or emergent – that change information and actors' interactions by amplifying initial conditions through feedback loops.
Edge of Chaos	Non-equilibrium points at which critical factors concerning systems and actors are poised to force a shift to a strange new attractor.
Bifurcation	A point where qualitative change between two states occurs leading to irreversible organizational transformation.
Iteration	A cycle of repeating behavior and interaction of strange attractors that provides positive feedback to amplify initial conditions.
Connectivity	Relationship network that supports knowledge flow and feedback.

Changes that take place in response to a chaotic state are referred to as *bifurcations.* A bifurcation point indicates a breakdown in the equilibrium of a system. An abrupt disruption in the structure and direction of a system triggered by an initiated action, a crisis, or a catastrophe (Adams & Stewart, 2015; Lartey, 2020b; Remuzzi and Remuzzi, 2020; Vanderford, 2007). This central property of chaos theory suggests that a bifurcation involves a qualitative change in the behavior of a dynamic system that nears or reaches the edge of chaos, and results in a new alternative state. While such a new state is irreversible per chaos theory, the next bifurcation can result in a shift back to a previous behavioral pattern, yet that pattern may not be the same as the previous occurrence.

Strange attractors are organizing agents that promote stability and rein in a system's behavior. Their role is to assist with the re-emergence of new order (Beabout, Carr-Chellman & Alkandari, 2008). Strange attractors' behavior may change at any time and may disrupt the organization's stability by moving the behavior to a new strange attractor. And finally, *self-organization,* the most promising property of chaos theory, is the consequence of a bifurcation whereby disruption gives way to system's renewal and a new structure that emerges from a chaotic state.

Referring again to COVID-19, we can view the pandemic evolution and ensuing dynamic processes and outcomes through the prism of key features of chaos theory. *Initial conditions* are critical in understanding how a microscopic virus spread from one initial person to infect millions and cause colossal damage to global economies. The chaotic state that ensued led communities, cities, and central governments to introduce radical changes, or *bifurcations,* primarily in daily practices and behaviors. Such changes indicate a breakdown in the equilibrium of entire systems affecting the economy, health services, and social behaviors. The abrupt disruption caused by the COVID catastrophe has forced massive structural and procedural adjustments. Leading such efforts are *strange attractors,* change agents in the form of COVID taskforces. In the U.S., taskforces were headed at the federal level by the Vice President, and at

state level by the governors. These organizing agents' main task was to introduce a measure of stability and predictability in U.S. government and state operations, leading to *self-organization,* that ultimately culminates in a new order. The new order manifests itself in promising new vaccines, new governmental structures and capabilities, and replenishing inventories as the U.S. continues to emerge from the chaotic state. This continuous self-organization phase is well reflected in private-public partnerships, innovation in medical testing, pharmaceutical alliances, revised supply chains, and improved coordination between federal and state governments.

Thus, an analysis using chaos theory, seeks to identify events involving decision choices, relationship shifts, and drivers of behaviors towards strange attractors. Taken together, chaos theory's properties shed light on paradoxical dynamics characteristic of chaotic circumstances, the unpredictability and disorder of a chaotic state, and the re-organization and renewal that emerges in the aftermath of a chaotic event.

Such a cycle is well documented in numerous works that investigated large scale disasters such as the events of September 11, and particularly events associated with Hurricane Katrina (Adams & Stewart, 2015; Beabout, Carr-Chellman & Alkandari, 2008; Vanderford, 2007). One emerging notion shared by these studies is that even in a state of chaos, whether by design or by default, organizations can re-organize, transform, and rebuild.

Chaos and Conflict

Guastello (2008) provides perhaps one of the most vivid images of the link between chaos and conflict using oscillators, pendula and what is known as the three-body problem. In doing so, he highlights pathways that link attractors with unpredictability, and bifurcation with self-organization. All, of course, are key properties of chaos theory with implied relevance to conflict.

Guastello proposes three basic pathways for a system to experience conflict and turn chaotic. One way follows the application of what is referred to as the three-body problem. Consider an attractor field with three attractors each with a different strength representing different positions on a given issue. The probability for a conflict occurs when a new position enters the field. It is then pulled in different and unpredictable directions and is likely to attract attention from at least two directions. Thus, a bilateral agreement, for instance, may not resolve a conflict if there are three or more interest groups. Furthermore, the odds of parties revising their positions in favor of a solution often increases as the number of interest groups increases. And, chaos is just about guaranteed in the case of four parties with four different positions (Guastello, 2008).

Guastello's first pathway can be best illustrated by the multi-lateral nuclear agreement between world superpowers and Iran. There were multiple parties to the agreement – The U.S., Russia, France, UK, Germany, China, and Iran - representing seven attractors with varying strength led by the U.S. as the dominant power. Each country had its own interests and goals that were not compatible with those of other parties; goals ranged from allowing Iran to continue its nuclear effort under supervision, to curtailing its ability altogether. It took years to bridge the multilateral conflicting positions and negotiate a time-bounded temporary agreement that masked the conflict rather than resolved it. The twists and turns that were characteristic of the lengthy negotiation process reflected the chaotic state steaming from shifting interests and positions, and an overall sense of uncertainty and risk. As Guastello asserted, the odds of parties revising their positions in favor of a solution often increases as the number of interest groups increases. Chaos abounded with seven parties and varying positions that required an exhausting negotiation

process, and that necessitated offering various inducements to Iran. An alternative in the form of a bilateral agreement between the U.S. and Iran existed, but as suggested by Guastello, a bilateral agreement would have not been able to resolve the conflict given the large number of interest groups involved. There were five other parties with self-serving competing interests, in addition to the U.S. and Iran, with each one eying a larger piece of the pie: Iranian oil and investment opportunities for their own companies.

A second pathway involves what Guastello calls coupled oscillators. Using a vivid image of a set of three pendula, when the first pendulum oscillates, the middle one moves faster with a motion that is complex, while the third pendulum swings chaotically. Now, consider for example, a network of three organizations that are part of the same supply chain. If one organization, represented by the first pendulum, is dominant and exerts more power than the other two organizations, the latter may experience some level of entropy. Moreover, the supplier that is represented by the third pendulum, is more likely to be negatively affected by the unpredictable chaotic motion it finds itself in. This organization may experience little control over its environment within the supply chain coupled with a heightened level of uncertainty and risk.

Here too, the Iran nuclear agreement can be used to illustrate the coupled oscillators and pendula as a second pathway to chaos and conflict. With Russia and China willing to cooperate but reluctant to impose a settlement that antagonized the Iranians, it was left to the U.S. to do the heavy lifting with the tacit support of the European powers. The U.S. is the dominant power, thus representing the first pendulum, the Europeans represented the second pendulum, and Iran facing the world powers represented the third pendulum. The U.S. forced the nuclear issue to the forefront by imposing severe economic sanctions on Iran, hence pressuring all parties to the negotiation table. Its pendulum, using Guastello's image, oscillated forcefully in one direction propelling the European pendulum to move forward faster toward the negotiation table. Iran, represented by the third pendulum and exposed to crippling sanctions, experienced a heightened level of entropy, and was negatively affected by the unpredictable chaotic motion it finds itself in when facing what it perceived as a unified front of world powers against its nuclear aspirations. It is likely to assume that the Iranian regime felt a significant amount of uncertainty and risk that ultimately propelled it to accept an agreement.

A third pathway to chaos, suggests Guastello, involves a bifurcation mechanism and a control parameter capable of raising a system's level of entropy that is associated with unpredictability and risk. Consider for instance, a system that is pressured to change in the face of new market dynamics and mounting competition. As the pressure for change increases, the system will tend to oscillate rather than stay stable. Further pressure turns the oscillations more complex, shifting among multitude of behavioral patterns that are more chaotic. For clarification, the concept of bifurcation asserts that a party or a system is initially stable, but as pressure to change increases, the system will tend to oscillate between its old pattern of behavior and a new one. Further pressure overcomes the system's control parameter and leads to chaos with workflow and communication becoming more complex and inconsistent. At this phase, the system tends to be self-organized and regain stability.

Using the Iran nuclear agreement to illustrate Guastello's third pathway, the current turn of events triggered by the U.S. pulling out of the agreement, brings the relationships of the world powers with Iran to a boiling point and sharpens the conflict between Iran and the U.S. The current economic pressure that the U.S. exerts on Iran, as it seeks to revise the nuclear agreement's terms, is so crippling that it forces the Iranian's economic and political systems to

oscillate rather than stay stable, and results in shifting behaviors among regime actors and the populace. Such behaviors are reflected in Iran's widespread civil demonstrations, as well as in the conflicting views expressed by the radical versus moderate ruling camps. Iran today appears restive and in a chaotic state. Further pressure from the European powers may force the system to oscillate between its old belligerent behavior and a new one that is more moderate. In the meantime, as one can observe, it is possible that the additional U.S. sanctions imposed recently on Iran may overcome Iran's internal "control parameter," thus resulting in more chaos and inconsistent communications and messages. As chaos theory suggests, such a chaotic state may ultimately lead to a positive change, self-organization, and transformation.

Guastello's pathways suggest that chaos and conflict are intertwined with change, and thus are an integral part of organizations' existence. They shape and are shaped by market dynamics and by a multitude of intra-party interactions. One should consider present day organizations' exposure to numerous stakeholders, extensive internal interactions, and the scale of exchanges taking place in their external ecosystem. Tackling adequately future challenges will depend on organizations ability to react properly to outside pressure, on the adequacy of internal processes for mitigating risks and associated costs, on the organization's ability to manage chaos and conflict, and on assuredly regaining stability.

Conflict Theories and Chaos

Three conflict theories with varying degrees of shared properties with chaos theory are of interest and are briefly discussed: Conflict dynamic systems perspective (Coleman, 2014), constructive controversy (Johnson, Johnson & Tjosvold, 2014), and the PSDM model (Weitzman & Weitzman, 2014). We limit our commentary to the very essence of each theory by focusing only on those aspects that are relevant to the thrust of our paper.

Conflict Dynamic Systems Perspective

Conflict dynamic systems perspective, also referred to as dynamical systems theory, is one approach that offers insight into systems' change and resistance to change, and by extension, to the study of conflict as well (Coleman, 2011; Vallacher, Nowak, Coleman, Bui-Wrzosinska, Leibovitch, Kugler, and Bartoli, 2013). Coleman (2014) views conflict as being largely about change, a view that is in line with Marcus' (2014) argument that change triggers conflict more often than not, and with his assertion that conflict serves the vital purpose of awakening motivating forces that shake the status quo. Exploring the persistence of long-term conflict, Coleman (2014) utilized conflict dynamic systems perspective for investigation of non-linear progression of conflict, and particularly intractable conflict. He likened deeply rooted conflict to epidemic; it grows slowly at first but quickly develops and spread exponentially, turning into a massive event of great magnitude. This characteristic is reminiscent of the butterfly effect, a key attribute of chaos theory. Both approaches refer to this process as a non-linear change.

Building on unique properties of conflict dynamic systems, Coleman charts a path for the dynamic process that ensues as conflict develops. Accordingly, "interrelated problems begin to collapse together and feed each other through reinforcing feedback loops, which eventually cross a threshold and become self-organizing…. these conflict systems become attractors. Strong, coherent patterns that draw people in and resist change." (Coleman, 2014, p.724). It appears that like the vital role that attractors play within a chaotic context, conflict related attractors serve a

socio-psychological purpose. They support a coherent view of conflict, its history, legitimacy, and inter-intra relationships that exist between the parties, and they provide some measure of stability for action by enabling parties to promptly respond as circumstances change. Reflecting on attractors' vital role, Coleman (2014) proposes that deep conflict, particularly an intractable one, is governed by strong attractors for negative dynamics and weak attractors for positive dynamics. Being cognizant of the attractors' landscape, whether positive or negative, is thus important. And, as vital is the awareness of initial conditions that exist between the parties to the conflict. For instance, isolate issues that coalesce together, have the capacity to create a chain reaction whereby a single issue triggers all other issues, thus further exacerbating the conflict. Under such an escalation, finding an acceptable solution that encompasses all issues is less likely even if the triggering issue is addressed.

Applying attributes of conflict dynamic systems to conflict resolution, Coleman proposes to leverage instability as an opening act, embrace complexity, be cognizant of initial conditions, seek meek power as conflict is circumvent, leverage visible and invisible attractors, and re-stabilize the parties' interactions and course of action through feedback and adaptation.

Theory of Constructive Controversy

Constructive controversy views a deliberate discourse that involves a thorough examination of the pros and cons of critical actions as vital and necessary. Such examinations are designed to synthesize novel solutions as a product of creative decision making (Johnson, Johnson & Tjosvold, 2014). Johnson, et al., suggest that "engaging in the constructive controversy procedure skillfully provides an example of how conflict creates positive outcomes." (p.102). For instance, constructive controversy theory suggests that a position and its rationale be challenged by opposing views, thus resulting in a conceptual conflict, disequilibrium, and uncertainty about the correctness of the position and rationale. This process generates a healthy dose of epistemic curiosity that in turn triggers active searches for new information and additional perspectives. The process culminates in synthesis and integration of ideas that produce a superior joint reasoned judgement encompassing the multitude of expressed views of all the participants (Johnson, et al., 2014).

Unlike chaos theory's view of disorder and randomness, this advocacy-based inquiry procedure is orderly and rational and yields some valuable benefits according to Johnson, et al., (2014). For one, it leads to higher quality decisions and solutions to complex problems. In addition, controversy is conducive to a more frequent use of higher-level reasoning strategies and involvement in controversy, often tends to result in attitude and position change.

The PSDM Model

In its core, the problem solving and decision making (PSDM) model, emphasizes a rational approach to cooperative conflict resolution (Weitzman & Weitzman, 2014). While rationality and linearity stand contrary to chaos theory's core idea and attributes, they do stand at the heart of the PSDM model. Being cognizant of decision-making biases that interfere with rational thinking is important. Among such biases, Weitzman and Weitzman (2014) list irrational escalation of commitment to an initial course of action; assuming a zero-sum-game approach; basing judgement on irrelevant information; and, viewing the conflict in negative terms thus emphasizing losses rather than gains.

Being aware of the negative effects of those potential biases, PSDM aims at minimizing them by employing a deliberate multi-step linear process – a four-phased problem solving and decision-making process. Weitzman and Weitzman (2014) suggest that it should be viewed as a foundation for a broader conflict resolution process. The model's phases are: the diagnosis of the conflict; identification of alternative solutions; evaluation and selection of a mutually acceptable solution; and a commitment to, and implementation of the decision.

Conditions that encourage problem solving and persuasion strategies are shaped by a psychological climate characterized by cohesion, fairness, recognition of success, and openness to innovation (Weitzman & Weitzman, 2014). Being cognizant of such conditions is important, but so is the mastery of problem-solving techniques such as expanding the pie, logrolling, and bridging. The authors explain that pie expansion entails creating more of a resource to be divided, while logrolling involves conceding on issues that each party considers less important for the purpose of creating good will. And, bridging involves creating new options to meet critical interests. In a word, collaboration and cooperation are likely to help overcome bias, and utilizing one or more of the mentioned techniques helps in reaching a win-win outcome.

Shelton and Darling (2004) contend that reaching a win-win outcome is difficult to achieve through a linear process, given that conflict resolution is a paradoxical process, and given that each party seeks a solution that may initially appear to be diametrically contrary to the other. Still, a win-win resolution demands the ability to overcome such divergent positions, making the adoption of a joint problem-solving and decision-making approach, as proposed by PSDM and theory of constructive controversy, an irreplaceable and a necessary option.

Chaos and Conflict Theories: Shared Attributes

By sharpening the similarities and differences between the mentioned theories of conflict and chaos, we hope to gain a better understanding of shared aspects and establish a foundation in support of practical implications for managers and conflict resolution practitioners. We attempted to capture our key arguments in Tables 2 and 3. Specifically, Table 2 depicts areas of congruency within and across the reviewed theories. With a few exceptions, Table 2 suggests multiple areas of agreement amongst our theories around specified properties. And, Table 3 captures succinctly, but with more clarity, key attributes that are shared by chaos and conflict theories. Thus, commenting briefly on a few shared aspects appears warranted.

First, conflict dynamic systems' notion of leveraging instability is tantamount to the infusion of chaos into a system as advocated by chaos theory. Conflict, and more so a deeply rooted one, favors conditions characteristics of closed systems such as keeping the status quo, and rejecting change. Opening such system requires the introduction of deliberate shocks in the form of new terms and conditions that are meant to jolt the system and destabilize it. Both conflict dynamic systems perspective and chaos theory view the initial step of purposefully creating fissures in the system as a necessary condition for realignment of conflict landscapes, followed by transformation and system renewal.

Table 2. Chaos and Conflict Theories: Congruency Window

Properties	**Conflict Dynamic Systems Perspective**	**PSDM Model**	**Constructive Controversy Theory**	**Theory of Chaos**
Sensitivity to initial conditions	✓	✓	✓	✓
System/cognitive shocks by design	✓		✓	✓
Behavioral attractors	✓			✓
Cycle of change	✓	✓	✓	✓
System re-organizing, and renewal	✓	✓	✓	✓
Non-linear tendency; randomness	✓			✓
Core benefits: Positive value and outcomes	✓	✓	✓	✓
Information exchange	✓	✓	✓	✓

Second, embracing complexity in the face of chaos and instability is shared by both theories; it is designed to strengthen actors and parties' tolerance of contradictions and ambiguity, and discourage oversimplification of chaos and conflict related issues. Within the context of conflict, Coleman, Vallacher, Nowak, Coleman, Bui-Wrzosinska, and Bartoli (2011) suggest using conflict and feedback-loop mapping as a means for enhancing complexity. Conflict mapping depicts the history and evolution of the conflict, its trajectories, and its broader networks, thus shifting parties' attention away from the immediate pressing context.

Third, sensitivity to initial conditions is another central tenet that is shared by both theories. Sensitivity to initial conditions appears to be equally important within the context of conflict and especially a deeply rooted one. Research suggests that the initial encounters between parties to a conflict shape the exchanges that follow. Such sensitivity is manifested in situations where even slight differences in initial conditions result in far larger differences between parties to a conflict (Leibovitch, Naudot, Vallacher, Nowak, Bui-Wrzosinska, and Coleman, 2008). From a conflict dynamic systems perspective, the existing emotional reservoirs of the conflict – namely, the ratio of positive experiences to negative experiences of each party to the conflict - also matters. Thus, an initial excess in positive experiences is likely to offset negative ones, and hence the importance of creating attractors for constructive relations between the parties down the road (Kugler, Coleman & Fuchs, 2011).

Fourth, visible and latent attractors play a critical role in shaping a system's state as conditions change. Like their role in a chaotic state, attractors in a conflict can experience a rapid change in their states due to social processes, and the shift from one attractor pattern to another. For instance, during a less destructive conflict state, positive attractors are visible and negative attractors are latent. However, during a destructive conflict, negative attractors are visible while positive attractors are latent (Coleman, 2014). A latent positive attractor argues Coleman has the potential of triggering a de-escalation of conflict, that can lead to a resolution between parties.

Thus, strengthening attractors that promote positive relations between disputants is a promising strategy for effectively managing conflict.

Finally, regaining stability following systems reorganizing and renewal is an additional shared property by both chaos theory and conflict dynamic systems perspective. But, unlike chaos theory's adherence to non-linear processes, dynamic adaptivity as a stabilizing process within the conflict dynamic systems perspective introduces rational decision-making and problem solving into conflict systems. According to Coleman (2014), regaining stability in relations between parties to a conflict requires a fairly structured process of defining core issues, exploring more than a single solution, demonstrating flexibility in decision making, willingness to change course, and being open to feedback. In short, adopting adaptivity.

Much like conflict dynamic systems approach, theory of constructive controversy appears to share a key assertion with chaos theory. Both theories support the notion that introducing conflict in organizations, to capitalize on its constructive potential and positive outcomes, should be structured and supported. Constructive controversy relies on argumentative clash to erupt and evolve amongst participants. Thus, enabling new ideas and a cognitive change to surface much like the chaotic states that give way to new order and transformation. However, unlike the non-linear change that is characteristic of chaos theory, constructive controversy employs a rational, linear driven decision-making process much like the PSDM model of conflict resolution (Weitzman & Weitzman, 2014). This process, an advocacy-based inquiry procedure, calls for researching a position, advocating that position, analyzing, and critically evaluating opposing views, reversing perspectives, synthesizing, and integrating all views, and summarizing them into a joint position (Johnson & Johnson, 2007).

While chaos theory shares significant attributes with both conflict dynamic systems and constructive controversy, it has little in common with the PSDM model. In fact, from a pure decision-making perspective, they appear contradictory. PSDM is driven by a linear and a structured process, and views accurate information gathering and rational data assessment as a prerequisite to sound decision making. Chaos theory, on the other hand, focuses on non-linear unpredictable phenomena that adhere to non-known rules. It is congruent with the assertion of bounded- rationality whereby human's information processing abilities are limited. As such, chaos theory stresses discontinuity while rejecting the need for accurate data and complete information as a pre-condition for decision making. In a word, it considers them unrealistic and unobtainable given that events do not necessarily resemble past occurrences.

And yet, notwithstanding the core difference between PSDM and chaos theory's approach to decision making, and despite the appearance of the four phases of the PSDM model as rational and orderly, the PSDM process is not strictly linear as Weitzman & Weitzman (2014) suggest. Often, it necessitates regressing back to an early phase before moving forward to the next phase. The possibility of regressing back is similar to the quality of a bifurcation shifting back to a previous behavioral pattern under the theory of chaos. Here too, a regression back does occur often despite the theory's attribute of irreversibility.

And, like chaos theory's key assertion concerning change, PSDM too views conflict as an opportunity for change and growth. Furthermore, much like the connectivity and information exchange that are central to chaos theory, PSDM considers information sharing and mutually acceptable solutions as the hallmark of the problem-solving approach. Cooperative problem-solving approaches in mediation, argues Weitzman & Weitzman (2014) are indeed essential.

Taken together, the sheer number of common properties that emerges from our discussion points to a high degree of congruency between the theories in question, with implications for

both organizations and practitioners alike. Our discussion suggested that chaos and conflict are intertwined with change, and thus are an integral part of organizations' existence.

Table 3. Chaos and Conflict Theories: Shared Attributes

Properties/Theories	**Conflict Dynamic Systems Perspective**	**PSDM Model**	**Constructive Controversy Theory**	**Theory of Chaos**
Open Systems Principles	Open system open mind; values flow of information; interaction with other systems.	Seeks new info. from various sources; open exchanges lead to informed positions & behavioral change.	Flow of info. is critical; open exchanges lead to open mind & novel solutions.	Values flow of information & exchanges with its environment. Iteration leads to bifurcation.
View of Conflict/chaos	Awakens motivating forces; rattles the status quo; pre-requisite for renewal.	Inevitable, accepted, managed; opportunities for change.	Cognitive conflict is essential; facilitates novel solutions; enables new ideas.	Challenges the status quo; a condition to be encouraged; leads to transformation.
Initial Conditions	The nature of initial encounters shapes exchanges that follow; existing emotional reservoirs of the parties' matter.	Determines the depth of the problem; help define direction for a solution and for relevant decision making.	Opening position of parties determines conceptual conflict; dictates strength of opposing views.	Great sensitivity to initial conditions; Butterfly Effect matters; small changes lead to major effects.
Linearity	A win-win outcome is difficult to achieve through a pure linear process. Deeply rooted conflict calls for non-linearity view.	This model calls for a multi-phase linear process all through.	A linear and a rational approach to a cooperative conflict resolution.	Focuses on non-linear unpredictable phenomena; adhering to non-known rules.
Attractors	Conflict related attractors serve socio-psycho purpose; assist with emergence of new order.	No specified role.	No specified role.	Patterns of b'vior; agents that promote stability; facilitate transformation.
Bifurcations	A qualitative behavior change; reflects a breakdown in equilibrium.	No specified role.	No specified role.	Responses to chaotic state; disruption gives way to renewal.
Self-Organization	Part of cycle of change; leverage instability, embrace complexity, seek latent positive attractors, re-stabilize interactions, and reorganize around course of action.	Not specified but alluded to: the parties re-organize after joint problem-solving and decision making.	Not specified but alluded to: disequilibrium culminates in synthesis and integration of ideas, and reorganization of positions.	A final phase that is part of cycle of change; internal shocks leads to change and systems self-organization and renewal.
Feedback	Feedback-loop mapping is a critical ingredient for enhancing	Continuous feedback from parties is a critical ingredient of PSDM process.	Feedback drives the examination of pros and cons of critical issues and actions.	Connectivity as an attribute of the theory, ties relationship network together

	complexity/depicting conflict evolution.			and is guided by knowledge flow and feedback.
Collaboration	Conflict related attractors serve socio-psycho purpose through collaboration.	Collaboration is at the heart of a joint problem-solving and decision-making approach.	The active search for new information and perspectives can only be done via joint effort and collaboration.	Collaboration is a necessary condition for effective functioning of an open system.

Chaos and conflict ought to be positively considered as they carry a value and a promise for change and transformation that ultimately lead to renewal for organizations; such a change may manifest itself in the quality of relationships and interactions amongst individuals and groups. Avoiding either concept means a loss of opportunities for change and evolvement. Referring to the calamitous pandemic is unavoidable when searching for an event that amplifies our central theme and concluding message. COVID-19 catastrophe has left death and disruption in its path that may alter the way people live and work indefinitely. Yet, as predicted by conflict and chaos theories, the conflict that ensued and the chaos befallen world economies have spurred promising change and renewal processes that are still unfolding. For one, the race in search for a cure propelled the healthcare industry to higher level of cooperation and collaboration; it compelled governments to better coordinate testing related services and restock on medical gear and equipment, and it gave impetus to new diagnostic discoveries and medical innovation on a global scale. COVID-19 has darkened our skies, but it also brought about the coming together of communities despite the imposed work from home and social distancing. And, it may have made us all better prepared for another global pandemic (Malka and Tiell, 2021).

Recommendations and Practical Considerations

Our discussion yields several practical recommendations and implications that are applicable to organizations and individuals alike. The message to managers is straightforward: Chaos and conflict offer opportunities for change by challenging the status quo and by facilitating innovation. Therefore, embrace them! Furthermore, do not despair - as even in a state of conflict and chaos, whether by design or by default, organizations and disputants can re-organize, transform, and rebuild new systems and relationships.

Thus, consider both chaos and conflict and remember that they should be viewed as a condition to be encouraged. Keep in mind that harmonious groups and organizations are prone to becoming static, rigid, and less responsive to innovation and change. Be cognizant of the possibility that such a state, if persistent, will ultimately lead to stagnation and entropy. And so, capitalize on chaos' and conflict's constructive potential by purposefully creating fissures in the system as a necessary condition for realignment of conflict landscapes.

Considerations for Organizations: The Chaos Perspective

- *Considering the benefit of being a healthy process*. Chaotic behaviors and changes caused by non-linear dynamics, systems breakdowns, and bifurcations are considered healthy processes that should be encouraged.

- *Considering the benefit of being an open system*. Chaos theory suggests that organizations are open systems capable of self-organizing. As such, they possess and employ self-corrective mechanisms capable of fighting stagnation and promoting renewal and transformation. Being an open system, implies being a learning organization with the capacity to absorb and process external information for adaptation.
- *Considering the benefit of being a catalyst for change*. The impetus for change and revitalization are systems breakdown triggers by isolated peripheral events, or by key actor who creates a chaotic state by design as a catalyst for change. Chaos theory fosters disturbances of system equilibria as a means for stopping entropic decline. Thus, organizational actors are encouraged to induce periodic system shakeups as corrective measures for change and renewal.
- *Considering the benefit of being an early warning alert*. Nonlinear relationships and randomness that characterizes systems transactions and interactions ought to be dealt with and managed by non-linear chaos approaches. As such, chaos theory can explain chaotic changes and trends, and predict future patterns of 'order out of order.' It is seen as an early warning alert system for organizational actors, suggesting that chaotic states can surface anywhere and anytime.
- *Considering ethical aspects*. Chaos theory may promote deliberate state of chaos, and as such, it can be an instrument of manipulation and control raising ethical questions that should not be ignored by organization actors (Farazmand, 2003). Furthermore, due to the butterfly effect in its core, and the unpredictability inherent in chaotic changes, it becomes difficult to predict directly related consequences, as well as secondary ones that may ensue.

Considerations for Conflict Resolution: The Conflict Perspective

- Be aware of the resemblance between the processes leading to a constructive conflict resolution and successful change efforts. Remember that resistance abounds in both processes, thus harnessing the energy of resistance forces is more critical than displacing it.
- Leverage instability as an opening act and embrace complexity. Be cognizant of initial conditions and leverage visible and invisible attractors. Seek to stabilize the parties' interactions and course of action through feedback and adaptation.
- And yet, strive to keep parts of the system stable, as an increased level of induced instability may be overwhelming to parties in a conflict. Regaining stability in relations between parties to a conflict requires defining core issues, exploring more than a single solution, demonstrating flexibility in decision making, willingness to change course, and being open to feedback. In short, adopting adaptivity (Coleman, 2014).
- Be cognizant of attractors' landscape. A latent positive attractor has the potential of triggering a de-escalation of conflict, that can lead to a resolution between the parties. Thus, strengthening attractors that promote positive relations between parties to a conflict is a promising strategy for effectively managing conflict.
- Embrace a cooperative problem-solving approach in mediation by encouraging the parties to leverage the dynamics associated with collaboration. Collaboration enables the crafting of joint solutions for resolving friction and destructive conflict.

A final thought: Decades before the emergence of Covid-19, Levy (1994) illustrated how small disruptions taking place in a supply chain end up inflicting major unpredictable challenges for companies. Such supply chain disruptions led to the idling of production lines and to a significant reduction in revenues and increase in production costs. Levy concluded that applying chaos theory to firm operations is promising and should be expanded and used as a framework for predicting and coping with unpredictable events. The still unfolding events triggered by Covid-19, make Levy's conclusion more relevant today than ever. When considering the pandemic's unpredictability and associated costs, the single most important lesson for organizations and managers is that employing yesterday's tools for forecasting is insufficient, and that long-term planning does not ensure stability or sustainability. Dramatic events like Covid-19, coupled with complex external developments such as new technologies, changing demographics, and market competition necessitate operational flexibility, adaptation, and a new managerial mindset. The fixation with stability ought to be replaced with an approach that is more suitable for today's complex and unpredictable environment. Chaos theory is one such approach that should be further explored and adopted by organizations and their managers.

The author acknowledges the help of Chet Watson, Sullivan University Librarian. Chet invested precious time helping with the collection of relevant studies that form the backbone of this manuscript.

References

Adams, T., and Stewart, L. (2015). Chaos theory and organizational crisis: A theoretical analysis of the challenges faced by the New Orleans Police Department during hurricane Katrina. *Public Organization Review*, 15, 415-431.

Beabout, B. A., Carr-Chellman, K., and Alkandari, L. (2008). The perceptions of New Orleans educators on the process of rebuilding New Orleans school system after Katrina. *Journal of Education for students Placed at Risk*, 13, 212-237.

Coleman, P.T. (2014). Intractable conflict. In P.T. Coleman, M. Deutsch & Marcus. E. C. (Eds.), *The handbook of conflict resolution: Theory and practice* (3rd ed.), (pp. 708-744). San Francisco, CA: Jossey-Bass.

Coleman, P. T. (2011). *The five percent: Findings solutions to seemingly impossible conflicts.* New York, NY: Public Affairs.

Coleman, P. T., Vallacher, R., Nowak, A., Bui-Wrzosinska, L., and Bartoli, A. (2011). Navigating the landscape: Applications of dynamical systems theory to protracted social conflict. In N. Rogers (Ed.), *Systemic thinking and conflict transformation*. Berlin: Berghof Foundation for Peace Support.

Cvetek, S. (2008). Applying chaos theory to lesson planning and delivery. *European Journal of Teacher Education*, 31, 247-256.

Farazmand, A. (2003). Chaos and transformation theories: A theoretical analysis with implications for organization theory and public management. *Public Organization Review: A Global Journal*, 3, 339-372.

Forero, J., and Perez, S. (2020, April 24). Ventilator hunt spurs no-frills innovation. *The Wall Street Journal*, p. A8.

Gleick, J. (2008). *Chaos: Making a new science*. New York, NY: Viking Press.

Guastello, S. (2008). Chaos and conflict: Recognizing patterns. *Emergence: Complexity and Organization*. *10*(4), 1-9.

Haynes, P. (2007). Chaos, complexity, and transformations in social care policy in England. *Public Money and Management*, 27, 199-206.

Johnson, D., Johnson, R., and Tjosvold, D. (2014). Constructive controversy: The value of intellectual opposition. In P.T. Coleman, M. Deutsch & Marcus. E. C. (Eds.), *The handbook of conflict resolution: Theory and practice* (3rd ed.), (pp. 76-103). San Francisco, CA: Jossey-Bass.

Johnson, D. and Johnson, R. (2007). *Creative controversy: Intellectual challenge in the classroom* (4th ed). Edina, MN: Interaction.

Kellert, S. H. (1993). *In the wake of chaos: Unpredictable order in dynamical systems*. Chicago, IL: University of Chicago Press.

Kugler, K. G., Coleman, P. T., and Fuchs, A. M. (2011). *Conflict, complexity, and openness: Constructive vs. destructive discussions on intractable issues*. WOP Working Paper No. Conflict models2011/3. Retrieved from www.psy.lmu.de/ wirtschaftspsuchologie/ forschung/working_ papers/index.html

Lartey, F. M. (2020a). Chaos, Complexity, and contingency theories: A comparative analysis and application to the 21st century organization. *Journal of Business Administration Research, 9*(1), 44-51.

Lartey, F. M. (2020b). Ethical challenges of complex products: Case of Goldman Sachs and the synthetic collateralized debt obligation. *International Business Research, 13*(6), 115-127.

Leibovitch, L. S., Naudot, V., Vallacher, R., Nowak, A., Bui-Wrzosinska, L., and Coleman, P. T. (2008). Dynamics of two-actors corporation-competition models. *Physica* A, 387, 6360-6378.

Levy, D. (1994). Chaos theory and strategy: Theory, application, and managerial implications. *Strategic Management Journal*, 15, 167-178.

Lin, L. and Xiao, E. (2020, April 24). China medical-goods market is 'wild west.' *The Wall Street Journal*, pp. A1, A8.

Lorenz, E. (1963). Deterministic non-periodic flow. *Journal of Atmospheric Science*, 20, 130-141

Malka, S. C. (2020). What should your organization know before embarking on the exploration-exploitation journey? The exploration-exploitation paradox: Insights, considerations, and managerial implications. In T. Bilak, & L. Wilkin (Eds), *From discord to harmony.* Charlotte, NC: Information Age Publishing.

Malka, S. C., and Tiell, R. (Eds.)(2021). Back to a New Normal: *In Search of Stability in an Era of Pandemic Disruption - Insights from Practitioners and Academics.* Charlotte, NC: Information Age Publishing. (In press).

Marcus, E. C. (2014). Change and conflict: Motivation, resistance, and commitment. In P.T. Coleman, M. Deutsch & Marcus. E. C. (Eds.), *The handbook of conflict resolution: Theory and practice* (3rd ed.), (pp. 513-532). San Francisco, CA: Jossey-Bass.

Mason, R. B. (2009). Management actions, attitudes to change and perceptions of the external environment: A complexity theory approach. *Journal of General Management, 34*(1), 37-53.

Meek, J. W. (2010). Complexity theory for public administration policy. *Emergence: Complexity and Organization, 12*(1), 1-4.

Mintzberg, H. (1987, July/August). Crafting strategy. *Harvard Business Review*, 66-75.

Mintzberg, H. and Waters, J. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal, 6*(3), 257-272.

Nguyen, H. L., and Kock, S. (2011). Managing SMEs' survival from financial crisis in a transition economy: A chaos theory approach. *Journal of General management, 37*(1), 31-45.

Remuzzi A. & Remuzzi, G. (2020). COVID-19 and Italy: What's next? *Health Policy,* 395, 1225-1228.

Sanial, G. (2015). Exploring U.S. Coast Guard organizational preparedness through chaos and complexity theories. *Emergence: Complexity and Organization*, 1-16.

Shelton, C., and Darling, J. (2004). From chaos to order: Exploring new frontiers in conflict management. *Organization Development Journal, 22*(3), 22-41.

Theodoridis, C., and Bennison, D. (2009). Complexity theory and retail location strategy. *The International Review of Retail, Distribution and Consumer Research*, 19, 389-403.

Vallacher, R., Nowak, A., Coleman, P. T., Bui-Wrzosinska, L., Leibovitch, L., Kugler, K., and Bartoli, A. (2013). *Attracted to conflict: The emergence, maintenance, and transportation of malignant social relations*. New York, NY: Springer.

Vanderford, M. (2007). Emergency communication challenges in response to Hurricane Katrina: Lessons from the centers of disease control and prevention. *Journal of Applied Communication Research, 35*(1), 9-25.

Weitzman, E., and Weitzman, P. (2014). The PSDM model: Integrating problem solving and decision making in conflict resolution. In P.T. Coleman, M. Deutsch & Marcus. E. C. (Eds.), *The handbook of conflict resolution: Theory and practice* (3rd ed.), (pp. 203-229). San Francisco, CA: Jossey-Bass.