

# Finding a common framework for the analysis of social and institutional change: A retrospective and an exploration

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**T**his essay describes a potentially useful framework for analyzing social and institutional change. It draws heavily on insights from evolutionary and complexity theories, and employs explanatory models that are based on the mathematical analysis of complex dynamical systems. The proposed framework goes beyond the boundaries of the traditional social sciences, and therefore has the distinct advantage of enabling us to look at social and institutional change from a much wider theoretical perspective.

## Introduction: The Need for Trans-disciplinary Approaches in the Study of Social Phenomena

The different sciences that have evolved since the dawn of the Age of Enlightenment look at specific aspects of the biological, physical and social worlds. These disciplines have developed into highly specialized fields of study among which there is a notable lack of meaningful discourse even among those that fall within particular clusters of the traditional disciplines. This is especially true in the social sciences. For good reasons, the social sciences have been faulted for their collective failure to see the interconnectedness of the entire range of human experience, and for their inability to capture useful insights that can be discerned from these highly complex and extensive interdependencies. To this day, the social sciences rest snugly in their respective knowledge domains and continue to look at the different aspects of society and the institutions within these spheres

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through the lenses of their unique theoretical perspectives, using their peculiar jargon and arcane methodologies, and prescribing wide-ranging, divergent and at times incompatible policy directions for society.

The lack of dialogue among the social sciences has resulted in a fragmented view of social issues and concerns and has been a source of frustration among social scientists and social policy planners alike.

This discomfiture is also felt by university students on whom their professors tend to foist their disciplinary biases. While we often pay lip service to so-called multidisciplinary or inter-disciplinary academic programs and course designs, what is perhaps needed more than anything else are approaches that are truly *trans-disciplinary*, those that seek explanations of complex and dynamic phenomena that transcend the principles and methodologies employed by the traditional disciplines.

## Evolutionary and Complexity Theory Perspectives in the Social Sciences

Two major developments in the world of knowledge appear to be moving the different sciences in that direction. These trends, one having had its beginnings in biology and the other in physics, are starting to exert an important impact on the way we view complex and dynamical biological, physical and social systems. We look at these in turn as they relate to the social sciences.

## KEYWORDS

Complexity theory, evolutionary theory, punctuated equilibrium, cusp catastrophe, logistic map analysis, self-organized criticality

## *Evolutionary Thinking in the Social Sciences*

The social sciences, notably economics and sociology, have traditionally focused on institutions and formal organizations as units of analysis. With the publication in 1859 of Charles Darwin's *On the Origin of the Species*, and the continued universal acceptance of biological evolutionary theory, this institutional focus has invariably led to an increasingly wider recognition of the relevance of evolutionary concepts in the study of institutional and social change.

### *Evolutionary Sociology*

Sociology, along with its close cousin, anthropology, has had a long tradition of rendering evolutionary explanations on organizational and social change.

There currently are two main approaches in analyzing the process of institutional and social change through the lens of evolutionary sociology (Sanderson 2001, Dietz et al. 1990). One thrust has been vigorously pursued by sociobiology, a major sub-area of sociology. Founded by the iconic American naturalist Edward O. Wilson, sociobiology seeks to understand the biological foundations of human organization and culture. Wilson and his fellow socio-biologists popularized the concept of gene-culture co-evolution, the process by which the human species and human culture and society evolve hand in hand (Wilson 1998, Wilson 2000). The inter-dependence between the biological and the cultural evolution of humans has also been the main focus of socio-cultural evolution, an important sub-discipline of evolutionary anthropology (Klüver 2008).

The other approach seeks to describe and explain the process of long-term institutional and social growth and development in terms of the three basic Darwinian concepts of variation, selection, and transmission. This approach is typified by the works of Michael Hannan and John Freeman who co-developed a population ecology theory of organizations. In their landmark 1977 article, Hannan and Freeman explained the shift in organizational forms as being the outcome of a process by which the environment "selects" from a population of institutions those which are destined to survive (Hannan and Freeman 1977).

Coincidentally, it was on the same year as when Hannan and Freeman came out with their population ecology thesis that Harvard sociologist Talcott Parsons formalized, rather late in his illustrious career, his own evolutionary theory of social change. According to this model, social institutions become more and more specialized as they evolve, and hence more effective in their performance of their functions for society. In the process of their development, they become increasingly adapted to and less

dependent on society for their continued existence. According to Parsons, the extent to which institutions are *differentiated* from one another, and the degree to which they are *integrated* to the larger social system, distinguish modern societies from the less developed ones (Parsons 1977, Bortolini 2007).

### *Evolutionary Political Theory*

Among the social sciences, political science has been a "Johnny come lately" in developing evolutionary themes. While political scientists use the term "evolutionary" in describing some aspects of their work, they do so rather lackadaisically, usually referring to changes in political preferences or in political structures and processes without fully understanding their evolutionary underpinnings (Alford and Hibbing 2004). The discipline cannot be faulted for not trying, however. Aware of the general lack of appreciation of the relevance of evolutionary biology in the study of political systems, processes and behavior in their discipline, political scientists, mostly from American and European universities, converged in June 2010 at a conference held in Florence on the topic, "Evolutionary Theory in Political Science." Co-organized by the Department of Political Science of the European University Institute and the Robert Schuman Center for Advanced Studies, the conference sought to bring together scholars representing the different sub-areas of political science for the purpose of sharing insights and learning from one another [http://www.eui.eu/Documents/DepartmentsCentres/SPS/ResearchAndTeaching/Workshops/EvolutionaryTheoryWokrshopSteinmoJune2010.pdf]

### *Evolutionary Economics*<sup>1</sup>

The history of evolutionary thinking in Economics dates from 1776 with the publication of Adam Smith's classic work, "An Inquiry into the Nature and Causes of the Wealth of Nations." This event marked the birth of the new science of economics (known at its incipience as political economy). This new discipline has since pursued an evolutionary tradition.<sup>2</sup>

Institutional economics, with its distinctly evolutionary perspective on the workings of firms, markets and economies, reached its apogee at around the turn of the 20<sup>th</sup> Century. Foremost among the institutional economists of the day was Thorstein Veblen who, in 1898, published his landmark article "Why is economics not an evolutionary science?" in the *Quarterly Journal of Economics*. More enthusiastically than anyone else, Veblen applied the Darwinian principles of variation, inheritance and natural selection in the study of institutions, markets and economies (Veblen 1898). Several decades into its later development, classical economics used biological metaphors in explaining the behavior of firms, industries and markets, a tradition that

<sup>1</sup> The bulk of this sub-section is based on, and in some instances, was lifted from Poblador (2012).

<sup>2</sup> Little known to many, Charles Darwin (who, with his contemporary, Alfred Russel Wallace, co-founded modern evolutionary biology) has been influenced to some degree in his views on the workings of complex living systems by the writings of Adam Smith and Thomas Malthus, both of whom preceded him by several decades.

continued up until the early years of the 20th century.

The strong ties between evolutionary biology and economics started to wane with the emergence of neoclassical economics in the 1870s. At around this time, economics started to take inspiration from physics rather than from biology. While many classical economists, notably Alfred Marshall, continued to apply evolutionary concepts in their writings, the love affair between biology and economics had started to fizzle out.

Many prominent American economists during this period such as Michigan's Kenneth Boulding, Carnegie Mellon's Herbert Simon and Stanford's Kenneth Arrow had long been staunch advocates of the application of evolutionary concepts in economics and had helped sustain interest in institutional and evolutionary perspectives in the field. However, two landmark publications during this period helped renew the long-standing bond between biology and economics and set the tone in re-establishing institutional economics as a credible alternative to the existing orthodoxy.

First was the publication in 1950 of Armen Alchian's landmark article, "Uncertainty, Evolution and Economic Theory" in which he argued that economic rationality, the hallmark of neoclassical economics, is not a given but is the result of learning and evolution, and that efficient behavior tends to persist through time over inefficient ones (Alchian 1950).

The second major work, published in 1982, was *An Evolutionary Theory of Economic Change*, by Richard Nelson and Sidney Winter (1982). This landmark publication gave new credibility and vitality to institutional economics and helped re-establish the strong bonds between biology and economics.

Institutional and evolutionary approaches to economics have in recent years become more and more widely accepted as credible alternative paradigms to the existing orthodoxies (Hodgson 2005, Hodgson 2007).

#### *Evolutionary Thinking in History*

A quick search on the Web for "evolutionary history" yielded no results, and instead led to what is known in the profession as "Historiographic Darwinism," defined as the analysis of "the broad historical context in which Darwin's biological views were conceived," (Preston 2010). It is, in a word, the historical account of Darwin's theory of evolution. While historians have written on the history of evolutionary thinking, they appear not to have adopted it as part of their own methodology. By all accounts, there is no Darwinian view of history.

Epochal changes in societies and civilizations can be labeled loosely as "evolutionary" in the sense that they reflect the exceedingly slow process of adaptation to challenges posed by their environments. However, historical accounts of the growth and decay of societies and civilizations do not, as far as we

know, apply the social and cultural equivalents of Darwin's concepts of variety, selection, and transmission, much less of genes as the basic transmitter of biological traits. To do this, there is a need for history to shift focus on human institutions and organizations as carriers of inheritable social and cultural attributes, and to give more prominence to their complex interdependencies.

#### ***Complexity Theory Perspectives in the Study of Social Phenomena***

In May 1984, nuclear scientist George Cowan and several other scientists representing the different disciplines got together to form what eventually became the famous Santa Fe Institute. This assemblage of scholars and the ensuing collaboration among them resulted in the birth of Complexity Theory which many of its more ardent adherents enthusiastically call a "New Science".

Complexity Theory is a multidisciplinary approach to the study of biological, physical and social systems which comprise multiple components that react and adapt to continually shifting patterns that they co-create (Arthur 1999). Often described as lying at the edge of chaos, complex systems tread a narrow band between utter chaos on the one hand, and complete stability on the other, a sort of transition phase as they move from one state to the other. They are, in the words of one of the earliest exponents of Complexity Theory, "... a chaos of behaviors in which the components of the system never quite lock into place, yet never quite dissolve into turbulence either" (Waldrop 1992).

Complexity theory posits that while complex systems appear to be chaotic, they actually exhibit discernible patterns which tend to emerge into newer ones, albeit in a discontinuous and unpredictable fashion.

Complexity theory serves not as much as an alternative set of analytical tools as a general conceptual framework within which to apply the standard models and analytical procedures of the various sciences. It makes no claim to being a different theory, but serves only to provide a perspective for theorizing and modeling complex, dynamical systems. Complexity Theory helps in addressing the fundamental issues that lie at the core of extant social science theories, and provides useful insights that could serve as bases for policy directions and strategic choices (Walby 2003).

Complexity Theory has led to the now widespread view that human institutions and organizations are Complex Adaptive Systems, and the recognition of the importance of path dependence in the process of organizational and social change.

Complex systems have a number of other common properties which are of particular relevance in describing and analyzing the process of social and institutional change (Guastello 2002, Arthur 1999). These properties result in two important character-

istics that are common to all complex systems.

### *Extreme Sensitivity to Initial Conditions*

The state of complex systems at any point of time is the end result of their past histories. Moreover, their evolution through time is path-dependent and is generally irreversible. For these reasons, the initial conditions of complex systems at any point in time tend to be unique and extremely sensitive to any disturbance to which they tend to react spontaneously by creating new structures and behaviors through a process of *self-organization*. These responses tend to be discontinuous and unpredictable.

The process of self-organization is dramatically exhibited in the wild, as when a school of herring disperses and then regroups after an attack by a predator. Under similar conditions, social systems also behave in essentially the same manner. It is important to note, however, that earlier forms cannot and should not be construed as harbingers of forms that are yet to emerge.

### *Punctuated Equilibrium*

The evolution of complex systems tends to be slow and gradual, but their effects tend to accumulate over time. At some point, the slow process of change turns into a sudden, convulsive transformation, and totally new forms emerge. For example, in the course of their evolution, the emergence of new biological species or sub-species often takes long stretches of time. The long interval between the appearances of new forms can easily be mistaken as a sign that the system has settled momentarily into a state of equilibrium. *Punctuated equilibrium* is the term used by Eldredge and Gould to describe this phenomenon (Eldredge and Gould 1972). Physical and social systems, too, exhibit this tendency.

### *A Trans-Disciplinary Approach for Modeling Social Change*

Complex biological, physical and social systems are often portrayed as being non-linear, meaning to say, that changes in such systems rarely follow smooth and predictable paths. Rather, they are best characterized as being sudden, disproportionate, and unpredictable.

The change processes that take place in complex systems follow certain broad commonalities that are best perceived and understood by using analytical frameworks that transcend the traditional scientific disciplines. Catastrophe theory, developed by the French topologist René Thom in the late 1960s and which he presented in a book published in 1972, provides the mathematical basis for such a framework (Thom 1972). It is a special branch of bifurcation theory, which is the mathematical study of complex systems where small changes in certain classes of varia-

bles (called bifurcation parameters) cause sudden “qualitative” or “topological” shifts in the system.

In writing about Thom’s work, science historian and mathematician David Aubin described catastrophe theory as “... a cultural connector linking mathematics, biology, the social sciences and philosophy” (Aubin 2004). He cautioned, however, that “... catastrophe was not properly scientific theory, but rather *a method or language that could not be tested empirically and therefore was not falsifiable* ...” (emphasis supplied). While it serves as an overarching conceptual framework that provides us with a better understanding of the workings of complex phenomena, it has no predictive value. It is not, and has never been intended as an alternative to existing scientific theories. It is for this reason that catastrophe theory has yet to receive scientific legitimacy, and why it remains largely in the realm of scientific heterodoxy.<sup>3</sup>

### *The Cusp Catastrophe Model*

The Cusp Catastrophe Model (CCM) is one of several adaptations of catastrophe theory. The CCM has been applied in recent years in such diverse fields as sports psychology (Hardy 1996), job-turnover (Sheridan and Abelson 1983), faculty job satisfaction (McGhee 2008), and stock market crashes (Barunik and Vosvrda 2009). Its application in intervention research has been amply demonstrated in a wide range of experimental settings, such as in HIV research (Chen et al. 2010). We believe that this model is uniquely suited in many other applications such as in the design of learning systems, in product development, in mental health research, and for describing and analyzing institutional and social change in general. For example, in the current global scene, the CCM seems to be a potentially useful tool in determining the manner in which rogue states respond to increasing international sanctions.

The remainder of this sub-section outlines in non-technical terms the main features of this model.

Four disciplines have contributed to the development of the CCM, all of which trace their lineage from nonlinear dynamical systems theory. Often referred to as the “Four C’s” that underpin the CCM, these are: chaos theory, catastrophe theory, complexity theory, and cybernetics - in particular, the 2<sup>nd</sup> Law of Thermodynamics.

The CCM can be described as a simple three-dimensional model of complex systems consisting of two independent variables and a dependent variable which is non-linear and bimodal. In its most fundamental form, it is given by the function

$$z = f(x,y)$$

<sup>3</sup> This is particularly true in economics. While there have been a number of economists who applied catastrophe theory in analyzing certain classes of problems (see, for example, Varian 1979), the economics profession has generally tended to regard catastrophe theory with undisguised skepticism (Rossner 2004, p. 3).

where  $z$  is a non-linear, bimodal variable that describes the state of a system,  $x$  is a control variable which describes irregularity in the system (called the asymmetry factor), and  $y$  is one which describes the tendency of the system to split or diverge (bifurcation factor).

This function is depicted by the three-dimensional surface shown in Figure 1A, which features a two-dimensional manifold or topological surface.<sup>4</sup> The diagram shows that as the value of the bifurcation variable  $y$  increases from low to high, changes in the state of the system are initially smooth but eventually become discontinuous, depending on the value of the asymmetry variable  $x$ . High values of  $y$  combined with low values of  $x$  result in changes that are relatively small and occur at the lower stable equilibrium surface. High values of both  $x$  and  $y$  bring about small changes that occur at the upper stable equilibrium surface. High values of  $y$  and middle values of  $x$  produce relatively large changes that take place at the unstable equilibrium surface (Guastello 2002, Wahl 1986).

Figure 1B is a two-dimension rendition of Figure 1A which shows  $z$  as a function of  $x$ .

Wahl used this model to analyze the relationship among a community college faculty's job attitudes, perceptions of working conditions, and their levels of emotional involvement with their jobs. He found that increasing emotional involvement tends to polarize job attitude into high and low levels of job satisfaction. The ultimate results on satisfaction on the job - and how faculty members will respond to initiatives taken by their employer - depend on the given levels of emotional involvement and job attitude (Wahl 1986).

The CCM describes a complex system at a given point in time. It tells us how it may respond to any slight provocation, say, a random external disturbance or, in the case of social institutions, a strategic decision made by the agents who manage them. To employ the model in analyzing changes in the system, we need to explicitly introduce the element of time.

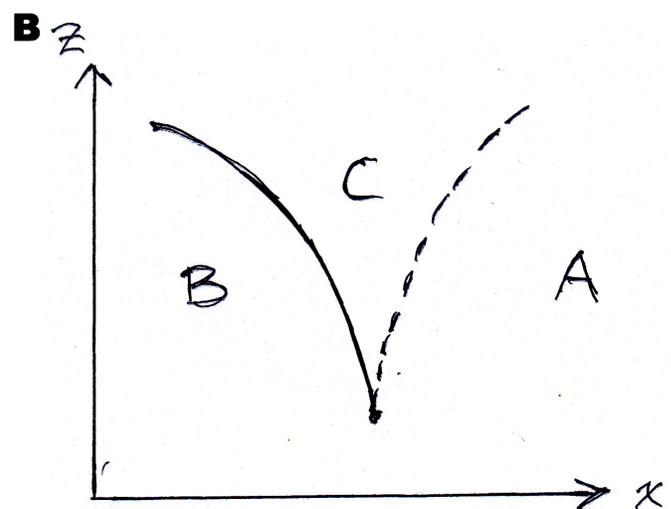
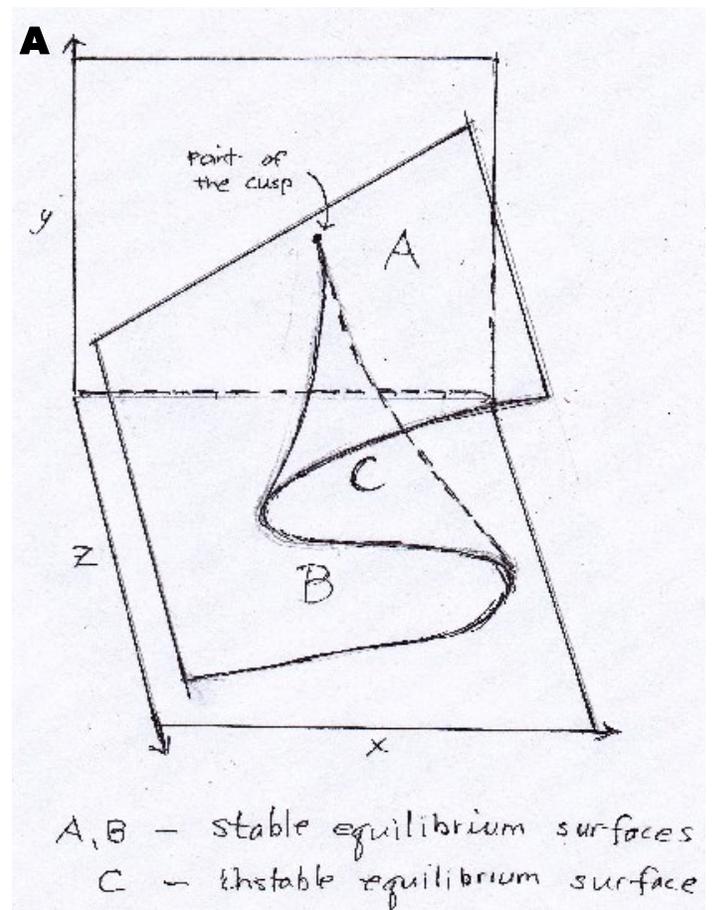
As complex systems move through time, they inevitably come to certain points where they veer in one direction or another, often rather violently and unpredictably. More often than not, the new paths taken are irreversible. Evolutionary and Complexity theories help us explain these bifurcations. These divergences from their historical paths reflect the systems' response to changes that take place within the unstable equilibrium surface shown in Figure 1, the area which lies within the vicinity of what is called the cusp point.

#### *The Dynamics of Social and Institutional Change*

The CCM broadly describes complex systems in general and

<sup>4</sup> The outer edge of this surface traces out a backward-bending "S"-shaped, or sigmoid curve.

how they potentially respond to any exogenous disturbance. However, in using this model on social systems such as business firms, government agencies and other forms of formal organizations, we have to bear in mind that social systems differ in some important ways from their counterparts in the biological and



**Figure 1. A**, The Cusp Catastrophe Model. Adapted from Fig. 2.3 in Wahl (1986), p. 32 and Fig. 2.17 in Guastello (2002), p. 50. **B**, A View of the Cusp Catastrophe Model on the  $z,x$  Plane

physical worlds. For one thing, social systems are characterized by their defining technologies, governance mechanisms and cultures, and in terms of which they differ substantially from one another. Moreover, changes in social organizations are often initiated not by random events but by deliberate actions taken by those who govern or manage them, decisions that are made in order to achieve specific strategic or operational goals. Social organizations, in a manner of speaking, are what Russell Ackoff calls purposeful systems (Ackoff 1972).

In responding to any exogenous disturbance, including those that are initiated by organizational managers for the purpose of achieving a desired state for the organization, the embedded socio-technical system tends to set off forces that either reinforce or hinder any further system changes. These forces vary in their directions and intensities, depending in part on the degree to which their technological, administrative and cultural sources are engrained in the organization. Changes in the state of the organization occur where the forces that exert pressure for change prevail over those that tend to restrain change. If the forces that favor change fail to overcome those that inhibit change, the status quo will prevail. Over time, changes in the balance of these opposing forces will determine the speed and direction of change, or indeed, if and for how long the status quo will remain.

As a general rule, organizations that are prone to change tend to have structures that emphasize lateral peer relationships rather than vertical authority relationships. They typically have cultures that are characterized by the pervasiveness of trust and openness and a greater degree of tolerance for ambiguity. Their incentive systems generally stress performance measures that reflect the organization's long-run sustainability rather than those that give immediate results that typically benefit specific stakeholders in the organization. Finally, innovative organizations are more likely to adopt governance mechanisms that co-align organizational, group and individual interest and encourage active participation in the decision-making process. Organizations with opposite characteristics, more often than not, tend to be mired in the status quo.

In describing and analyzing social and institutional change, the CCM can be recast by incorporating tools that have been extensively used in other areas of application. Among these are *bifurcation diagrams* which are commonly used in analyzing complex systems in Nature. By using these in conjunction with *force field analysis*, which is a standard set of tools used by Organizational Development (OD) practitioners, and by applying concepts drawn from the 2<sup>nd</sup> Law of Thermodynamics, we believe that a much better understanding of the change process in social systems can be developed, one that makes possible more meaningful comparisons across different types of social organizations.

Students of organizational behavior and organizational change management have for decades been applying a change management model developed by pioneering behavioral psy-

chologist Kurt Lewin. This model describes the change process in formal organizations as consisting of three stages – unfreezing, changing, and refreezing (Lewin 1951).

In many formal organizations such as business firms and government agencies, the *unfreezing* stage usually starts with a deliberate strategic or operational decision designed to improve organizational performance in some specified ways. These initiatives are usually parts of a broader planned organizational change strategy. For example, the governing board of a manufacturing firm may implement a new corporate-wide performance evaluation system as part of a broader program intended to enhance worker productivity. This administrative move can set off reactions from elsewhere in the organization that are either supportive of, or opposed to the change. Workers who feel that they will be adversely affected by the change will tend to exert pressure to resist it, while consumers who expect to benefit from the decisions in terms of better products will tend to support the move, as would shareholders who would expect corporate profits to increase.

The speed and direction of the ensuing *change* process will depend on the many other driving and restraining forces that this decision will generate. The status quo will tend to prevail in situations where the restraining forces dominate. Force field analysis will indicate where the system will tend to settle (see Figure 2), giving the change managers some clear indications on what ancillary implementing procedures to put in place in order to achieve the desired state. The *refreezing* stage takes place once this goal is accomplished. This usually consists of setting up new work procedures and control mechanisms and other measures intended to re-establish stability in working conditions and social interactions in the organization.

A simple graphic illustration of force field analysis is shown in Figure 2.

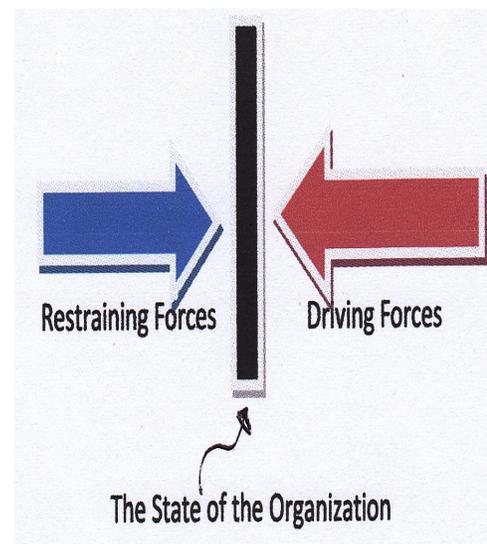


Figure 2. Force-Field Analysis.

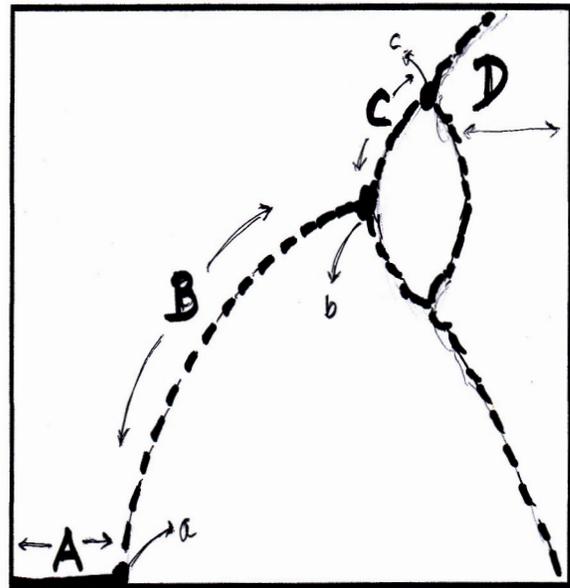
Following Guastello, the major features of force field analysis can be applied to a wider range of social systems by fitting these into the CCM and by utilizing concepts drawn from cybernetics (Guastello 2002).

In many other types of social organizations, the initial impetus for change could be any improbable random event that somehow gets out of hand and eventually brings about significant changes in the system. For example, the on-going upheaval in the Middle East known as the Arab Spring started when a young Tunisian fruit vendor set himself on fire after he was banned from selling fruits. This act of self-immolation, quite common in many parts of the world, enraged many of those who witnessed it and sparked the first open defiance of the autocratic and firmly entrenched Tunisian regime. The rest is now history. The suicide and the developments that followed it soon after this event started the *unfreezing* of the existing socio-political order in Tunisia and elsewhere in the Arab world. The *change* process is still ongoing in most parts of the region where opposing forces are still in the process of either building up or waning. A realignment of social, political and economic forces is still taking place in the region, most dramatically in Syria where the beleaguered al-Assad regime is still holding on to power. The *refreezing* stage is yet to take place, and the ultimate outcome of the current unraveling in the region is still anybody's guess.

Social, political and economic change can be described by means of what is known in the mathematics of chaos as *logistic map analysis*. A simplified approach to applying this tool can be done with the aid of bifurcation diagrams such as the one shown in Figure 3.

Portion A (Period 1) in Figure 3 represents the initial stable state of the system, a period which is characterized by a balancing out of potentially disruptive forces.<sup>5</sup> Because of this unique confluence of forces, the organization tends to remain at a standstill, often for long stretches of time.<sup>6</sup> This steady state cannot last indefinitely, however, especially in environments that are in a continuous state of flux.

Starting from this initial relatively steady state, the organization begins to gradually build up increasing levels of *entropy*<sup>7</sup> which, in its present context, is a measure of disorder or instability in the system. The level of entropy reflects both positive and negative feedback loops in the system and the resulting net bal-



**Figure 3.** A Bifurcation Diagram for Social and Organizational Dynamics. [Adapted from Fig. 4.6 in Guastello (2002, p. 93) and "Chaos Theory: A Brief Introduction"]

ance of forces between those that promote change and those that hinder change. It tells us whether the system has the tendency to remain still or to break up. Should the forces of change begin to dominate, the system eventually reaches a critical **bifurcation** point where meaningful change begins to unfold.

In Figure 3, point *a* is such a point. It corresponds to an initial external disturbance that tends to propel the system into an extended period of change<sup>8</sup> (Portion B in Figure 3). During this initial phase of change, clashes between conflicting new and old structures take place and the system fluctuates within certain bounds, at times calmly, and at times violently, depending on the changing values of the external disturbance(s). As the external forces of change intensify, the system eventually attains *self-organized criticality* (Bak and Chen 1991) and reaches another bifurcation point *b*, from which the system continues to oscillate, this time with increasing frequency and intensity.<sup>9</sup> As the process of change proceeds, the fluctuations in the system tend to be more and more violent, and the system becomes more and more complex. Entropy continues to build up along portion C until the system reaches another bifurcation point *c*. Eventually, the sys-

<sup>5</sup> This initial period can be likened to the state of the organization just before the start of the unfreezing stage in the OD change management framework. It must be stressed, however, that the terms "unfreeze" and "refreeze" are being used here only metaphorically because complex systems can never really be at a complete standstill.

<sup>6</sup> Punctuated equilibria is the term usually applied to describe successive stable states of complex dynamical systems.

<sup>7</sup> In thermodynamics, entropy measures the absence of adequate heat energy for conversion into mechanical work.

<sup>8</sup> Because complex systems have the common property of being extremely sensitive to their initial conditions, even relatively minor occurrences tend to trigger off disproportionately bigger and at times convulsive changes in the system.

<sup>9</sup> A bifurcation point corresponds to the cusp point in the CCM.

tem crosses over into the region of chaos (Portion D of Figure 3). Turbulence will persist for some time in the system, but eventually, new patterns begin to emerge and the system ultimately settles at a new stable state<sup>10</sup>—or finally disintegrates<sup>11</sup>.

### Conclusion and Policy Implications

Steve Jobs once famously said: “You can't connect the dots looking forward; you can only connect them looking backwards.”<sup>12</sup>

We cannot agree more with this observation. However, by bringing together complementary insights from evolutionary biology, complexity theory and relevant branches of mathematics, we are able to develop a truly trans-disciplinary analytical framework that would give us a better understanding of the process of institutional and social change. While this overarching framework does not allow us to predict outcomes from factual observations, it provides us with the ability to discern emergent patterns in organizations and other forms of social systems that are in states of varying degrees of instability<sup>13</sup>, and to nudge them gently into preferred directions or away from impending disaster. In this way, strategy becomes less a matter of putting in place a well-articulated program of action in order to achieve optimality, or something that approximates it, and more of establishing the necessary institutional conditions<sup>14</sup> that would allow the system to move in that general direction with a minimum of potentially disruptive human intervention.<sup>15</sup>

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### CONFLICTS OF INTEREST

None.

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<sup>10</sup> The emergence of a new stable state corresponds to the “refreezing” stage in the OD change management framework.

<sup>11</sup> The disappearance of old civilizations and the extinction of species are examples of system collapse.

<sup>12</sup> Stanford University commencement speech, June 2005.

<sup>13</sup> Emergent patterns of complex systems are said to be “ostensively recognized,” that is to say, that they are self-revealing (Goldstein 1999).

<sup>14</sup> See Thaler et al. (2010) for a discussion of “choice architecture” as an alternative approach to strategic decision making.

<sup>15</sup> For similar conclusions about the “disruptive” effects of human intervention, see Poblador (2011) and Diamond (2005).

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