Grounding Political Science in the Physical World

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Abstract

It is often assumed that the "two cultures divide" between the physical sciences and social sciences reflects a natural epistemological division of intellectual labor. If, however, human development occurs within a far from equilibrium thermodynamic context, as argued by complexity theorists like Edgar Morin and Ilya Prigogine, there is a need to bridge this divide with physically-integrated views of human society, including political systems. In this vein, it is proposed that the dynamics of opening, democratizing systems and closing, authoritarian systems reflect, respectively, the dynamics of opening and closing thermodynamic systems -- although in ways radically more complex than a physicist could ever identify in his or her lab. Operating variables shared across political and thermodynamic systems include degrees of self-organization and disorganization, openness and closure, unpredictability and predictability, and distance from equilibrium. Authoritarian systems are characterized by varying degrees of closure that drive political life toward a stifling predictability and equilibrium. Achieving order in a linear mechanistic sense, their primary function is to disorganize political life. Democratizing systems are open to new, less predictable forces that move politics away from equilibrium. When successful, they achieve for polities more diverse and more complex levels of self-organization. Empirical examples used to illustrate these dynamics include transitions from authoritarian rule to more open systems in Latin America, movements in the United States that have opened avenues of social and political participation once closed to blacks, women and gays, and current United States national security policies, some of which exhibit an equilibrium-oriented obsession with predictability.

Grounding Political Science in the Physical World

"…man must go back to Nature for information."
Thomas Paine in <u>The Rights of Man</u>, (2008:179)

"the greatest lessons of Nature through the universe are perhaps the lessons of variety and freedom"
Walt Whitman in "Democratic Vistas" (1909:197)

"…natural science has no way to conceive of itself as a social reality; human social science has no means of conceiving of its biophysical roots; science has no means to conceive of its social role and its own special nature in society."
Edgar Morin in <u>Science avec conscience</u> (2001:20) [1]

"Nature speaks with a thousand voices, and we have only begun to listen"
Ilya Prigogine and Isabelle Stengers in <u>Order out of Chaos</u> (1984:77)

Grounding Political Science in the Physical World

The Two Cultures Divide

The Physical or Natural Sciences — including — Physics, Chemistry, Biology, Geology

The Social or Human Sciences — including — Political Science, Sociology, Economics, Literature and the Arts

http://www.boomsbeat.com/articles/31/20140109/37-amazing-photos-that-capture-the-beauty-of-the-grand-canyon.htm

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The two cultures divide and political science

Efforts to ground political science in the physical world are as old as political science itself. When Aristotle called us "political animals", he saw humans as only one type of political animal, different from other political animals only by degree. "…man" he wrote "is much more

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[1] This is a translation of the Portuguese, itself a translation of the French. It reads: "...a ciência natural não tem nenhum meio para conceber-se como realidade social; a ciência antropossocial não tem nenhum meio para conceber-se no seu enraizamento biofísico; a ciência não tem os meios para conceber seu papel social e sua natureza in sociedade" (2001:20).

a political animal than any kind of bee or any herd animal…" (1984, 2013: 4). In this view, capacities like speech and reason give us a special political advantage but the bee, deer, cattle and the like are political because they also work out arrangements for living together in a community. Politics, in this sense, is not uniquely human but a phenomenon that occurs within nature at large. Understanding it requires we ground our studies in the physical reality within which we find ·ourselves as a species.

Yet, in our times, the physical dimension of political systems is at best a sideline issue, largely because political science stands to one side of the great chasm that divides what have come to be known as the "two cultures", the split between the physical and social sciences [2]. Politically, this divide has resulted in a physically disembodied view of human politics. While it is plainly evident that political systems are physical systems, neither political scientists nor physical scientists can explain how this is so using their own conceptual frameworks. Although politics is as physically tangible as voters standing in line at the polls, as arms waving avidly amidst heated debates over the rules of government in legislatures, courtrooms and executive offices, as banners held aloft by street protesters, as the incarceration and torture of political opponents, as bodies falling dead in warfare or in the murderous rampages of the Stalinist Purges, the Nazi Holocaust, or the Cambodian Killing Fields, politics as we now understand it cannot be discussed in the same breath with great theories of physical reality like evolution, the second law of thermodynamics, and Heisenberg's uncertainty principle. As Edgar Morin has noted about the social sciences generally, "Human science has neither a foundation that grounds human phenomena in the natural universe, nor methods that can grasp the extreme complexity that distinguishes human phenomena from all other known natural phenomena" (2008:8). For political science this has meant a failure to situate political phenomena within the natural world and a subsequent inability to compare the complexity of the material and biological realms with the vastly greater complexity of human politics.

Immanuel Wallerstein, in his book The Uncertainties of Knowledge (2004), claims that the two cultures divide places us in the midst of an epistemological crisis. He likens the crisis to a hurricane. He writes:

> "The modern structures of knowledge, the division of knowledge into two competing epistemological spheres of the sciences and the humanities, is in crisis. We can no longer use them as adequate ways in which to gain knowledge of the world…We are living in the eye of the hurricane."

In other words, the division of knowledge between the physical and social sciences is compromising the very process of scientific enquiry. It obscures for researchers fundamental aspects of reality, a point stressed by Edgar Morin when he noted that "The great disconnect between the natural sciences and the human sciences hides at once the physical reality of the latter and the social reality of the former" (1977:11) [3]. The challenge this poses to us as political
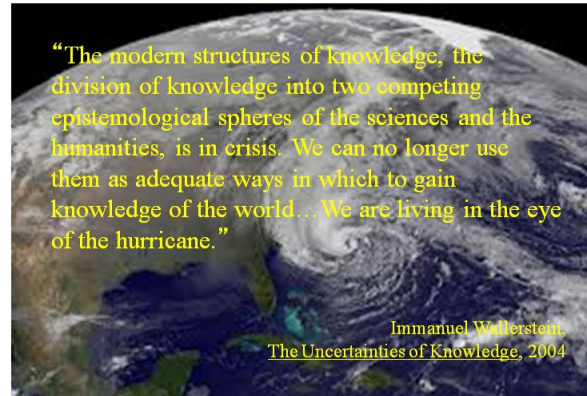
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[2] In a brief essay, C.P. Snow decried the "the incommunicability of the two cultures" (1956) by which he meant the "scientific culture" on the one hand (e.g. mathematics and physics) and the "traditional culture" one the other (e.g. literature and the arts). Since Snow's essay, many commentators have extended his notion of the "traditional culture" to include not just the humanities but also social sciences like economics, sociology and political science. It is in this broader sense that I refer here to the two cultures divide.

[3] In the original this passage reads «La grande coupure entre les sciences de la nature et les sciences de l'homme occulte à la fois la réalité physique des secondes, la réalité sociale des premières» (Morin, 1977 :11).

scientists is the following: we need to illuminate both the physical reality of politics and the political reality in which the natural sciences are embedded.

A possible approach to addressing the two cultures divide

In the highly speculative spirit with which such an extraordinary challenge must be engaged, I submit a combination of complexity theory and power theory, what I call a complexity theory of power. It is an attempt to elucidate the physical dimension of politics and develop a physically-integrated framework for the empirical analysis of power conflicts.

In opting for complexity theory as a means to address the crisis of the two cultures, I follow a path taken by Morin and Wallerstein. Although they appear to have worked independently of one another [4], both of them share not only a sense of urgency about the epistemological crisis but a belief that complexity theory offers the best way to navigate the crisis, in particular (as I discuss below) a current of the theory associated with Ilya Prigogine. I also concur with Edgar Morin that information theory has significance far beyond the electrical engineering applications Claude Shannon designed it for (1977:301-347), that its definition of information as negative entropy is parts of the complexity puzzle, that indeed each and every human is a "néguentrope par excellence" (1973:228).

Complexity theory has its origins in the physical sciences. How is it possible to make the leap from the physical realm to the nitty gritty of the political? My particular answer is relatively simple: through the testing of analogies. At the core of complexity theory are a set of closely interrelated physical concepts that are part of an historical break with classical ways to view order, disorder, certainty, uncertainty and equilibrium among other notions. By using these contested views to draw analogies of physical order to political order, physical disorder to political disorder and so on, it is possible to construct a similarly interrelated conceptual toolkit for political analyses, one that helps illuminate clashes over what constitutes political order and political disorder and offers insights into the democratization processes through which unequal political orders grow more equal. This builds on broad, easy to grasp complexity concepts. It does not require in depth scientific or mathematical knowledge. Indeed a literature major (as I

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[4] A search on Google Books (June 15, 2014) found only one reference made by Morin to Wallerstein and none made by Wallerstein to Morin.

was as an undergraduate) is probably better attuned to undertaking the metaphorical aspects of this exercise than someone steeped in statistical mechanics and nonlinear equations.

What is novel about my approach is the use of power theory to give complexity theory a political dimension. Complexity theory combined with a hybrid view of power, one that accounts not only for power exercised to dominate but for power exercised to build collaboration, opens a window into the nature of political complexity. I submit that the conceptual toolset of the proposed complexity theory of power makes a strong empirical fit for analysis of power conflicts at diverse scales. Empirical cases I touch upon here include a simple interpersonal power conflict like getting mugged (I offer a personal example) as well as democratization struggles that aim at or succeed in redressing inequities produced by one party imposing its will on another. These include movements in the United States that have opened avenues of social and political participation once closed to blacks, women and gays and transitions from authoritarian rule to more open systems in Latin America (for this I draw on my personal experience living in Brazil for three years during the height of military rule). It also would appear that some United States national security policies exposed by Edward Snowden exhibit patterns of an equilibrium-oriented obsession with predictability.

Overall the framework can be evaluated on the basis of how well its applications cast light onto such empirical phenomena.

Complexity theory

Like general systems theory and cybernetics, complexity theory originates in the physical sciences, holding open at the same time the prospect of developing a common language with the social sciences. To the extent that human complexity studies entail not just bridging but integrating the physical and social sciences, it shares in the spirit of Marx's speculation that "Natural science will in time incorporate into itself the science of man, just as the science of man will incorporate into itself natural science: there will be one science" (Marx, 1844; quoted in Morin, 1973:21). As of yet, however, many flavors of the theory exist; "…neither a single science of complexity nor a single complexity theory exists yet" (Mitchell, 2009: Kindle locations 332-334). Instead of discussing the merits of and issues posed by the varied approaches to complexity theory, I will go directly to an approach I believe to be the most promising for bridging the two cultures on a political level.

Complexity theory is part of a scientific revolution in physics which involves the clash of diametrically opposed views of order and disorder. In the traditional Newtonian view order is based on equilibrium. From a complexity perspective, however, order emerges out of far from equilibrium conditions. Fritjof Capra put it this way:

> "This new perception of order and disorder represents an inversion of traditional scientific views. According to the classical view…order is associated with equilibrium…In the new science of complexity…, we learn that nonequilibrium is a source of order…In living systems the order arising from nonequilibrium is far more evident, being manifest in the richness, diversity, and beauty of life all around us. Throughout the living world chaos is transformed into order" (Capra, 1996:190).

That is, order has polar opposite meanings depending on whether it is associated with equilibrium or nonequilibrium.

We get a fuller picture of this inversion when we include the views of disorder that accompany these conflicting views of order. Although disorder does not play an explicit role in the Newtonian schema, it is implied by any movement away from equilibrium. In the complexity paradigm, on the other hand, disorder is an integral feature. Its correlation with equilibrium makes it the inverse of disorder rooted in nonequilibrium.

The Mechanical	The Complex
EQUILIBRIUM-ORIENTED ORDER the Newtonian Clockwork Universe Nature is a machine, operating perfectly, following absolutely certain laws "problems of simplicity" (Weaver, 1948)	FAR FROM EQUILIBRIUM ORDER open system thermodynamics "problems of organized complexity" : (Weaver, 1948) Prigogine's theory of self-organization
FAR FROM EQUILIBRIUM DISORDER Disorder and uncertainty as anomalies	EQUILIBRIUM-ORIENTED DISORDER closed system thermodynamics "problems of disorganized complexity" : (Weaver, 1948)

If, instead of anchoring the comparison in terms of order and disorder, we do so in terms of equilibrium and nonequilibrium, we gain another angle on the inversion. While equilibrium correlates with order in the mechanical view, it is a source of disorder from a complexity perspective. Similarly, equilibrium's opposite, nonequilibrium, partners with disorder in the mechanical perspective but order in the complexity view.

The complexity view of reality effectively turns the tables on mechanistic Newtonian science.

What does "complexity" imply here? We can situate complexity within this framework using the three levels of complexity identified by mathematician Warren Weaver in his seminal essay "Science and Complexity" (1948). Weaver identified three successively more complex levels of problems: problems of simplicity, problems of disorganized complexity and problems of organized complexity. Each level corresponds to a new stage in the history of science and each requires a new type of mathematics.

The first level, problems of simplicity, corresponds with the largely two-variable problems characteristic of Newtonian science and for which Newton needed to invent calculus. In Newton's so-called clockwork universe, nature is a machine, operating perfectly, a deus ex machina following absolutely certain laws. Disorder and uncertainty are anomalies. In an order that is perfect, there can be no disorder. Where certainty is absolute, there can be no uncertainty.

By the end of the last century, pioneers like Boltzmann and Gibbs realized that, in order to analyze millions or billions of variables (as with, say, the particles in a ball of steam), absolute certainty would have to be abandoned in favor of a probabilistic, statistical approach. Such phenomena, distributed in "in a helter-skelter, that is to say a disorganized, way" (Weaver, 1948:3) represented what Weaver called problems of disorganized complexity. For these purposes, the calculus of Newtonian mechanics gave way to the probability-oriented statistical

mechanics of closed system thermodynamics, challenging in the process the absolute claims of Newtonian science. As Jacob Bronowski put it "One aim of the physical sciences has been to give an exact picture of the material world. One achievement of physics in the twentieth century has been to prove that that aim is unattainable" (1973: 353). This break with an absolutely certain and perfect natural order represents one of the great reality breakthroughs of science. In this view of reality, disorder and uncertainty can never be eliminated; they can only be reduced.

Missing in this picture was what Weaver called problems of organized complexity. He defined these as "problems which involve dealing simultaneously with *a sizable number of factors which are interrelated into an organic whole*" (1948:5, italics in original). Such problems, touched in one way or another by the wild card of life, introduced an element of the improbable, something beyond the comfort zone of scientists just beginning to master the realm of the probable. And human problems introduced the improbable like none other. "How" he asked "can one explain the behavior pattern of an organized group of persons such as a labor union, or a group of manufacturers, or a racial minority?" For these kind of phenomena neither minimal-variable nor statistical techniques apply. (1948:5) "These new problems, and the future of the world depends on many of them, requires science to make a third great advance, an advance that must be even greater than the nineteenth century conquest of problems of simplicity or the twentieth century victory over problems of disorganized complexity. Science must, over the next 50 years, learn to deal with these problems of organized complexity (1948:6)…A revolutionary advance must be made in our understanding of economic and political factors (1948:10)".

Now, going on 70 years later, it appears that science has indeed made great strides in learning how to address problems of organized complexity. Breakthroughs in recent decades in open far from equilibrium thermodynamic systems combined with nonlinear analytical methods have given traction to the study of this next level of complexity (Capra and Luisi, 2014). The proliferation of centers for the study of complexity around the world is just one measure of the great impact that complexity theory is now having. But, in an academe still split by the two cultures divide, the study of human complexity still lags behind the study of material complexity. The revolutionary advance that Weaver argued was needed to address problems at this level may have appeared on the horizon but its sun is rising very slowly.

Notable among physical scientists who have advanced this area of inquiry is Ilya Progogine. In awarding Prigogine its 1977 Chemistry Prize, the Nobel Prize committee noted that Prigogine's thermodynamics offered ways to bridge the physical and social sciences. [5] Prigogine identified a self-organizing dynamic in seemingly inanimate matter that has inspired novel ways of understanding self-development processes in living systems. Coupled with the dynamics of closed thermodynamic systems, such an approach offers new ways of modeling opening and closure processes that can be tested not only at physical levels but at the levels of human social systems. [6]

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[5] "Thus Prigogine's researches into irreversible thermodynamics have fundamentally transformed and revitalized the science, given it a new relevance and created theories to bridge the gaps between chemical, biological and social scientific fields of inquiry." (Nobel Prize Award Committee, 1977)

[6] A significant number of system theorists view human social systems as open by definition and thereby make closed system models inapplicable to the analysis of human social processes. Analysts like David Easton, for example, have argued that political systems exist in and must remain open to their environments, suffering virtual extinction if they close. In the proposed view, this as a reductionist application of biology-level systems to the

Prigogine's core concept, the dissipative structure, has become widely used in complexity theory. Dissipative structures are open far from equilibrium thermodynamic systems with both opening and closing potential. Importing energy from and dissipating waste into their environments, they are self-organized in the sense that they can persist or maintain themselves in a dynamic state of equilibrium for extended periods. In the face of structural crises, resulting from stressful interactions of internal and environmental processes, such systems reach bifurcation points whereupon they may evolve into more complex, more self-organized structures or break down through thermodynamic closure, diminishing in self-organization and complexity.

Although the notion of the dissipative structure grew out of Prigogine's chemistry work, its focus on self-organizing processes led Prigogine and others to speculate about its relevance at the biological and human level. Prigogine asserted that "…we can now recognize ourselves as a kind of evolved form of dissipative structure..." (1981:123). Although such a view remains controversial and poorly developed, it has attracted interest on both sides of the two culture divide. Biochemist Jeffrey Wicken, applying Prigogine's model to evolutionary theory, wrote that "the thermodynamic approach provides not only a natural continuity between the prebiotic and the biotic, but suggests further the extension of nature into the realm of economic and political structures" (1998:367). Sociologist Wallerstein, who developed an intellectual partnership with Prigogine (after he happened to drop in on a presentation Prigogine was making at a conference), sees in Prigogine's science the potential to overcome the two cultures divide. Prigogine, he writes,

> "…has moved physical science onto the central epistemological terrain of social science. He has renewed the call for a unified science, but not in the spirit of the analytic philosophers who wanted everyone to adopt the premises of Newtonian mechanics and become social physicists. Rather, he has in effect suggested that the natural scientists become part of a larger family in which the sociocultural premises and links of all knowledge activity be its unifying theme, one in which we overcome the two cultures because science and philosophy are conjoined activities deriving from a common epistemological base." (Wallerstein, 2004: Kindle locations 508-13)

Whence Newtonian science in the face of complexity? If closed system thermodynamics (disorganized complexity) cracked the edifice of Newtonian absolutism and any hopes its methodology might rule all of science, open system thermodynamics (organized complexity) completed its revolutionary overthrow. "In the deterministic world of Newton there is no history and no creativity. In the living world of dissipative structures history plays an important role, the future is uncertain, and this uncertainty is at the heart of creativity" (Capra, 1996:193).

This is not to underestimate the importance of Newtonian science. Thanks to Newton and his laws of motion, we can read in this morning's paper the precise times when the sun will set and when the moon, Jupiter, Saturn, Mars and Venus become visible. Moreover, we know these things to the exact minute from any location on earth. In our quotidian human time frames,

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immeasurably greater complexity of human social systems. At the level of human interactions, we are immersed in a kaleidoscopic, sometimes bewildering array of macro- and micro-level, nested and intersecting social systems, all with opening and closing potential, none of which, closed, ordinarily poses a survival threat to the society at large. Exhibit A of currently persisting political closure, in this view, could well be the almost seven decade old North Korean regime. To make political closure a theoretically inadmissible concept is to deprive system theorists of a badly needed analytical tool.

the solar system does seem to operate like a clock. Essentially the marvel of Newtonian science still holds when it sticks to its proper domain, its appropriate level of complexity – and when it concedes to modern physics that an element of contingency underlies the seemingly most predictable workings of the cosmos. The Newtonian clockwork only becomes a problem when its advocates portray it as a model for all of nature, for all of reality. Human freedom cannot fare well from efforts to make human behavior as predictable as the ocean tides. There are indeed some ramparts of the two cultures divide that need to be retained and fortified.

Another great advance in 20th century physical science that inspires some currents of complexity theory (e.g. Morin, 1973; Morin, 1977) is Claude Shannon's information theory. The question of information theory's relationship to thermodynamics is debated but made unavoidable by the curious fact that it measures uncertainty with the very same mathematical formula that closed system thermodynamics uses to measure entropy. It defines information as the reduction of uncertainty, the reduction of entropy or negative entropy. Mathematically it is physics' entropy with a negative sign in front of it.

These chameleon-like shifts from one apparent meaning to another have made information theory a source of many analogies, some relating to order and disorder (or organization and disorganization). For example, Norbert Wiener observed that "Just as entropy is a measure of disorganization, the information carried by a set of messages is a measure of organization" (1950:31). Information theory also offers an entrée into notions of freedom of choice. As Warren Weaver noted, "…information is a measure of one's freedom of choice when one selects a message" (1948:5).

Combining these analogies, we may assert another possibility, that organization is a function of freedom of choice and disorganization is a function denial of choice. This is suggested by one of the classic insights of information theory. It stems from considering the difference between the single possible outcome of a two-headed coin toss and the two possible outcomes of a regular coin toss. Because the choice presented by the two headed coin is a foregone conclusion, it really poses no choice at all. A two-headed toss provides no news, no information. A regular coin toss, on the other hand, creates uncertainty. It presents a choice. The result of the toss makes news. It produces information.

Plugging the number of possible outcomes into Shannon's mathematical measure of information, the logarithm for the two headed toss, log (1) to any power, always equals 0. The logarithm for the regular coin, log (2) to any power, always has some value greater than zero.

Or, viewing information as a measure of organization as Norbert Weiner suggested, the regular toss, because it presents us with some choice, measures some organization. The absence of choice posed by the single possible outcome, on the other hand, measures zero organization. This has political (albeit analogical) implications – to be made explicit later and tested with empirical cases.

Power theory: a hybrid approach

Among varied political science concepts that might prove helpful in giving complexity theory a political dimension, the concept of power appears to be particularly promising.

Amidst what Steven Lukes has called "an endemic variety of concepts of power" (Lukes, 1977:5), I propose a way to analyze one common type of power conflict. It occurs where the

exercise of power by A over B produces inequality and B exercises power to reduce or eliminate that inequality.

The aim of B in such a conflict is not to dominate A but to achieve power equality with A. Empirical examples of such change addressed later include the historical expansion of the suffrage in the U.S. and successful racial desegregation efforts of the American Civil Rights Movement.

For this purpose, I believe we need a hybrid approach to power, one that recognizes two very different power dynamics. There is, on the one hand, the oppressive exercise of power, power in the form of domination, power in which one party excludes, immobilizes or otherwise controls and imposes its will on another party. Large scale examples of such power include slavery, apartheid, and dictatorships. This kind of power is asymmetrical. It imposes inequality. I shall refer to it here as "power over" or power that is imposed, along lines similar to Dahl (1957, 202–03) and Lukes (1974, 30). [7]

There is, on the other hand, a radically different type of power. It is consensual. It is based on an ability to collaborate with others. It is the exercise of power to eliminate or lessen certain types of inequality – as with democratically empowering developments like emancipation, racial desegregation, or transitions away from authoritarian rule. It complements Arendt's definition of power as "the human ability not just to act but to act in concert" (1969, 1986:64). This type of power is symmetrical. Its exercise achieves greater equality among power actors. I will refer to as "power with".

Democratization may be understood, in this sense, as a process through which B overcomes inequality imposed by A, where, furthermore, B succeeds in exercising power with A on equal or more equal terms. It is the transformation of asymmetrical into symmetrical power relationships, or, at the very least, as a process of making unequal power relations less unequal.

A complexity theory of power

In order to make a formal proposition about a complexity theory of power here are two hypotheses.

First, power exercised as the choice of one person or group imposed on another is homologous to the equilibrium-oriented process of increasing entropy in a closed thermodynamic system. This is to say that power exercised to dominate others has a disorganizing effect on human relationships. In this view, the primary function of authoritarian political systems is to disorganize political life. Second, power exercised as mutual choice not ultimately imposed on others – or power exercised with not over others -- is homologous to the process of self-organizing in an open, far from equilibrium thermodynamic system. From this perspective, the primary function of democratizing political systems is to achieve greater degrees of self-organization.

This theory can be refuted by demonstrating that political power is merely analogous and therefore not homologous to physical processes in the manner suggested. By the same token, if, after rigorous testing with empirical data, such comparisons between the physical and political

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[7] Dahl suggested that "A has power over B to the extent that he can get B to do something that B would not otherwise do" (1957, 202–03). Similarly, Lukes proposed that "A exercises power over B when A affects B in a manner contrary to B's interests" (1974, 30).

resonate with an explanatory power extending beyond mere analogies, then the hypotheses may stand, subject to further review and testing. The case studies (better termed case sketches) are presented later in the hope of demonstrating such resonance.

How then build an analytical framework for this purpose? First, let's make political order and disorder analogues of physical order and disorder. Such analogies between the physical and political may be made explicit simply by inserting the word "political" into the framework. This poses the question of whether or not these conflicting views of physical order and disorder can offer insights into similarly conflicting views of political order and disorder and their associations with equilibrium or nonequilibrium.

A Complexity Theory of Power

The Mechanical	The Complex
EQUILIBRIUM-ORIENTED POLITICAL ORDER **A exercises power over B** **from viewpoint of A** From A's point of view, order ensues as long as B responds obediently and without question. Power imposed achieves a very real equilibrium-oriented order but it is a mechanistic human order; it mechanizes human relationships.	**NONEQUILIBRIUM POLITICAL ORDER** **B exercises power mutually with A** From a complexity perspective such questioning or disobedience introduces a bifurcation or power restructuring crisis whose end result, if B succeeds in exercising power on equal terms with A, is an enhanced state of self-organization.
NONEQUILIBRIUM POLITICAL DISORDER **Autonomous action by B** **from viewpoint of A** But for B to take some autonomous action – to question or disobey -- is to disrupt A's order, to generate disequilibrium and disorder.	**EQUILIBRIUM-ORIENTED POLITICAL DISORDER** **A exercises power over B** **from viewpoint of B** From the point of view of B, to be pressed toward equilibrium is the inverse of an orderly process. It is incapacitating and disorganizing.

This anchors each view of political order and disorder to its distance from equilibrium. Politically, it suggests an inversion of the meanings of order and disorder similar to what occurs with the conflicting physical views of order and disorder. In this schema, a complexity perspective associates political disorder with equilibrium, the inverse of the mechanical correlation with nonequilibrium; a complexity approach to political order similarly turns a mechanistic approach on its head by correlating it with nonequilibrium rather than equilibrium.

A framework for analysis of empirical instances of this type of power conflict begins to emerge when we map the hybrid approach to power to this schema. This approach places clashing perspectives over what constitutes order and disorder at the core of power conflicts.

From the mechanical perspective, the viewpoint of the party imposing power emerges. It is a mechanistic ideology of order and disorder. From A's point of view, order ensues as long as B responds obediently and without question. Power imposed achieves a very real equilibrium-oriented order.

As in the Newtonian schema, absolute certainty is the premise upon which A claims to have unquestionable authority. The mechanistic order is backed by an absolute moral certitude about its legitimacy, one that fuels intolerance of dissent. As John Stuart Mill wrote "To refuse a hearing to an opinion, because they are sure that it is false, is to assume that *their* certainty is the same thing as *absolute* certainty. All silencing of discussion is an assumption of infallibility"

(1859,1975:24, italics in the original). Dissent is crushed in the interest of "truths" that rise above questioning.

Such power regimes may persist for lengthy periods. B may internalize the viewpoint of A resulting in what Paulo Freire called "a culture of silence" (1972). When, however, B calls the inequity of the situation into question, A's imposition of power comes to be viewed as the inverse of an orderly process. It is incapacitating and disorganizing. While the order produced by imposed power is quite real, it is a mechanistic human order; it mechanizes human relationships; it is degrading, much as Frederick Douglass suggested when speaking of "the blighting and dehumanizing effects of slavery" (2008:29). Equilibrium instead of being a condition of political order is a source of political disorder. Like the result of the two-headed coin toss, the absence of choice produces zero organization or disorganization.

From this perspective, the absolute approach to certainty becomes a liability. "There is no absolute knowledge", Bronowski warned. "And those who claim it, whether they are scientists or dogmatists, open the door to tragedy." (353). It leads to a thermodynamic-like closure whose enforced conformity only succeeds in draining the life from political life, moving it toward a stifling predictability, an entropic-like process of the increasingly probable. As mathematician Robert Marks noted,

> "Social repression, under whatever slogan, is social inefficiency, an inhibition of feedback, disruption in the communication net. A self-steering system that blocks its internal information, its capacity for the nursing of novelty and innovation, loses its ability to meet new situations successfully. It diminishes in intelligence. It foredooms its strivings toward attainable goals in a universe of change. And it ends like the societies of the Mayans and the Medes, in probable extinction. This is not a prophecy, but a probability statement. It is statistical mechanics applied to a social net" (Marks, 1964:277).

Although claiming that extinction is the probable result of repression is an overstatement (see footnote 6), the more interesting claim here is that statistical mechanics, the mathematics of closed thermodynamic systems, is well applied to human society when describing social repression. It is a direct assertion that the oppressive exercise of power has an entropic-like effect.

If it is curious that "thermodynamics" can be mentioned in the same breath with "human repression", so also is the association that Jacob Bronowski made between Heisenberg's Uncertainty Principle and notions of political tolerance. Indeed Brownowski argued that, for both scientific and political reasons, the Principle should be renamed:

> "…the Principle of Uncertainty is a bad name. In science or outside it, we are not uncertain; our knowledge is merely confined within a certain tolerance. We should call it the Principle of Tolerance…. All knowledge, all information between human beings can only be exchanged within a play of tolerance. And that is true whether the exchange is in science, or in literature, or in religion, or in politics, or even in any form of thought that aspires to dogma. It is a major tragedy of my lifetime and yours that, here in Göttingen, scientists were refining to the most exquisite precision the Principle of Tolerance, and turning their backs on the fact that all around them tolerance was crashing to the ground beyond repair" (1973:365-366).

In the same excerpt from his televised documentary series, <u>The Ascent of Man</u>, Bronowski continued that

> "The Principle of Uncertainty or, in my phrase, the Principle of Tolerance fixed once for all the realisation that all knowledge is limited. It is an irony of history that at the very time when this was being worked out there should rise, under Hitler in Germany and other tyrants elsewhere, a counter-conception: principle of monstrous certainty. When the future looks back on the 1930s it will think of them as a crucial confrontation of culture as I have been expounding it, the ascent of man, against the throwback to the despots' belief that they have absolute certainty" (1973:367).

In face of the reality, both physical and political, that uncertainty can never be eliminated, intolerance of uncertainty can only have dire consequences whether in science, politics or any other realm of human activity.
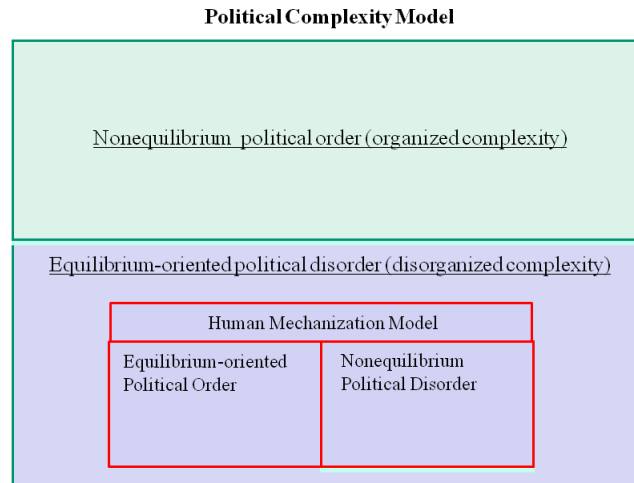
In the perfect absolutely certain Newtonian order, uncertainty and disorder are anomalies. Unquestioning obedience is the norm. In the eyes of A -- the party imposing power-- any display of non-conformity on the part of B is an expression of anarchy or chaos. It produces social and political disorder. It introduces nonequilibrium. Dissent, questioning, or any other challenge to the megamechanical order disrupts equilibrium. As the mere part of a machine, B cannot exhibit activity of any sort; autonomous action by B is intolerable. For a machine part to exercise freedom of choice is intolerable. The Greek root of the word choice is αἵρεσις or heresy. Choice as heresy lies at the core of the ideology of mechanized human order. As Adam Pzerworski has noted, "Under authoritarianism, there is no choice" (2003:266). In a realm of absolute certainty, the mere exercise of choice, the recognition of uncertainty, the act of questioning signifies insubordination and chaos. For A to question in a climate intolerant of questioning is to risk engagement with the enforcers of conformity and perhaps with violent forces of repression. For A, the restoration of order requires some way of neutralizing any who dare question. (In China one, one of the favorite terms of the Chinese Communist Party is a surrogate for the word order, namely harmony. Bloggers in China who fall victim to censorship speak of being "harmonized".)

The premise of absolute certainty through which uncertainty and disorder become anomalies often generates a ferocious moral energy directed at opponents. It is best characterized as Manicheanism or the personification of evil. Political Manicheanism demonizes political opponents and is one of the defining traits of the mechanized political order of authoritarian regimes. Political Manicheans may use broad catch-all terms like "enemies of the state" or "subversives". They may use dehumanizing terms like the "roaches" of tribal genocide in Rwanda or the "ugly microbes" (Chandler, 1992:136), "weeds" and "contaminations" (Ratner, Kindle 5162-65) [8] of Pol Pot's Cambodia.

A's mechanical view of political order and political disorder fits what might be called a human mechanization model. In the eyes of A, order persists if B, like a cog in a machine, conforms to the wishes of A. In A's view, failure by B to conform is to sabotage the machine. Inasmuch as the effect of pursuing these ideals of order and disorder is to move the system so governed toward equilibrium, toward the probable, toward the entropic, the entire human

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[8] Vaddey Ratner's book about life in Cambodia under Pol Pot is a novel but Ms. Ratner was as close to the reality as anyone could be. As a five year old, she was part of the forced evacuation of Phnom Penh and the rural resettlement. Much of her family perished before she escaped four years later.

mechanization model is best situated within the domain of equilibrium-oriented order or disorganized complexity.

Political Complexity Model

Nonequilibrium political order (organized complexity)

Equilibrium-oriented political disorder (disorganized complexity)

Human Mechanization Model

| Equilibrium-oriented Political Order | Nonequilibrium Political Disorder |

Democratization occurs when party B successfully contests the inequality resulting from power imposed by A on B. Such a development is typically preceded by a far from equilibrium bifurcation crisis – here interpreted as a power restructuring crisis. If B succeeds in exercising power on equal terms with A, in overcoming the domination of A, an enhanced state of self-organization is achieved. Examples discussed below include the achievement of voting rights by women and the dismantling of egregiously segregationist social practices by the black Civil Rights Movement in the U.S. Such transformation from the mechanistic exercise of power by A over B to the mutual and collaborative exercise of power by A and B mirrors self-organizing patterns in nature.

Democratization in this view is a path of political growth that complements growth in the physical or natural world. As such, it holds lessons for how we approach nature. As Capra notes,

> "Instead of being a machine, nature at large turns out to be more like human nature – unpredictable, sensitive to the surrounding world, influenced by small fluctuations. Accordingly, the appropriate way of approaching nature to learn about her complexity and beauty is not through domination and control, but through respect, cooperation and dialogue" (Capra, 1996: 193).

Indeed, in approaching nature, we are approaching ourselves.

Applying a complexity theory of power to empirical instances

Power dynamics cut across scale. A and B could be contesting nations, groups in a workplace conflict, or any two people involved in a personal interaction. Here are several examples that give some flavor of what happens when we test this framework with empirical data.

Case 1: Getting mugged

As we walk the streets where we live, if we are fortunate not to live amidst violence, we may feel a seamless freedom roaming where we wish. But all that can change on a dime.

14

Political Complexity Model: Getting Mugged

Nonequilibrium political order (organized complexity)
I regain freedom of choice if I succeed in getting mugger to back off

Equilibrium-oriented political disorder (disorganized complexity)
I am incapacitated by mugger "...the 'unquestioning obedience' that an act of violence can exact – the obedience every criminal can count on when he snatches my pocketbook with the help of a knife or robs a bank with the help of a gun" Hannah Arendt

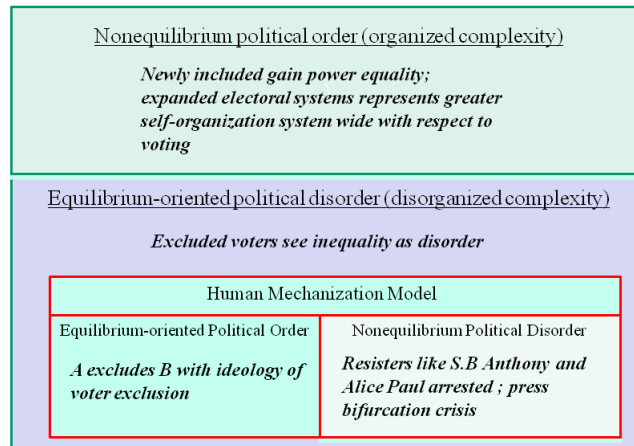| Human Mechanization Model	
Equilibrium-oriented Political Order	Nonequilibrium Political Disorder
I become mugger's ATM machine	*What if I resist?*

Consider the case of getting mugged. I've been mugged once in my life. (That it has only been once I am grateful). I was strolling down a sleepy side street of the Upper West Side of New York City in my normal carefree "far from equilibrium mode of self-organization" mode. The mugger jumped out from behind a parked car, flashed a knife in my face and demanded money. This action suddenly thrust me into a mechanical, equilibrium-oriented power relationship. One moment I was free to move as I wished; the next I was stopped dead in my tracks, not permitted to take another step. And I had become the mugger's ATM. Like an ATM, I was expected not to question or talk back but to simply hand over some money. In the eyes of the mugger, my obedience was essential to keeping this mechanical order intact or in a state of equilibrium. From my perspective, however, the inverse was happening. To be forced into the mugger's clockwork universe was to experience not order but disorder or disorganization. I was being incapacitated. I could disobey and throw the mugger's design into a state of disorder, into disequilibrium. If I was successful in foiling his plan, we would be equal partners in power. But I was afraid. I felt the paralyzing fear that often occurs with the threat of violence. My will gave way to Hannah Arendt referred to as "…the 'unquestioning obedience' that an act of violence can exact – the obedience every criminal can count on when he snatches my pocketbook with the help of a knife or robs a bank with the help of a gun" (1969, 1986:63). The knife in my face had the intended effect. I obeyed. I handed over whatever money I had in my pocket.

Case 2: Suffrage expansion and contraction in the United States

An historical sequence that seems to lend itself well to the proposed bifurcation model of democratization is the politics of expansion and contraction of suffrage in United States presidential elections since the country's founding. The original U.S. electorate was made up largely of white males with property. Over time this expanded to include, successively, all white males, black males (the 15th constitutional amendment in 1870), women (the 19th amendment in 1920) and adults 18 years of age, blacks who had been disenfranchised by racially restrictive state voting laws (the 1965 Voting Rights Act) and adults 18 and over (the 26th amendment in 1971). A notable contraction of suffrage occurred among black males not long after passage of the 15th amendment.

Political Complexity Model: Suffrage in the U.S.

Nonequilibrium political order (organized complexity)
Newly included gain power equality; expanded electoral systems represents greater self-organization system wide with respect to voting

Equilibrium-oriented political disorder (disorganized complexity)
Excluded voters see inequality as disorder

Human Mechanization Model	
Equilibrium-oriented Political Order	Nonequilibrium Political Disorder
A excludes B with ideology of voter exclusion	*Resisters like S.B Anthony and Alice Paul arrested ; press bifurcation crisis*

Each new system emerged out of a far from equilibrium bifurcation crisis that pitted an absolute, closed system against a new order of inclusion. As each new order emerged, it persisted for many years in a state of dynamic equilibrium, eventually becoming the old order to be challenged by new forces of inclusion. Each franchise system had its own ideology of inclusion and exclusion.

The electoral system established in 1789 by the Constitution gave eligible voters an unprecedented influence in the selection of a chief executive, even if that influence was indirect through an Electoral College. It produced partisan competition and, worldwide, marked the birth of modern political parties. But the vote was restricted to white male property owners. The ideology of exclusion was Locke's notion of "life, liberty and property". Men without property, the logic went, had insufficient responsibility to be trusted with the vote. It was an absolute line. Men thus excluded saw this as an injustice, an imposition of power, a type of disorder. Under the banner of "Universal Manhood Suffrage", a bifurcation crisis, a restructuring process occurred. It included major conflicts such as the Dorr Rebellion in Rhode Island in which disenfranchised state militiamen attacked the state arsenal. The following year Rhode Island amended its constitution to enfranchise all free men, regardless of race. In 1856, North Carolina became the last state to drop the property qualification for white male voters.

The racist ideology of white superiority caused the all male voter regime to persist as a closed system excluding, outside of New England, most free black males from voting. The Civil War, ultimately understood as an attack on slavery, was a most violent bifurcation crisis. It laid grounds for opening this system constitutionally in 1870. But, soon after the post-war "Black Renaissance" (in which the first blacks were elected to the U.S. Congress), closure and disenfranchisement set in, something that would not be remedied until almost a century later when the black Civil Rights Movement created a bifurcation crisis all along the color line that defined the boundary of a racially closed system.

The ideology of male superiority served as the absolute doctrine underlying the persistence and equilibrium of the exclusively male voting regime until 1920. Violators of this absolutism, the generators of nonequilibrium and a bifurcation crisis, included Susan B. Anthony who was arrested for voting in a presidential election in 1872 and the likes of Alice Paul who engaged in a civil disobedience campaign leading up to the 19th amendment.
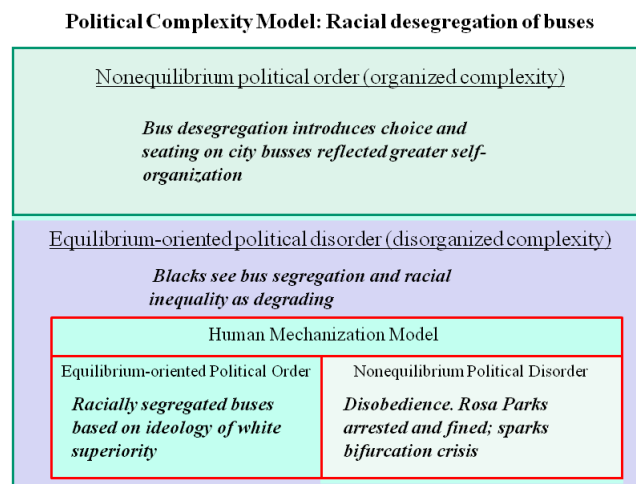
In 1968, over 16,000 American soldiers died in Vietnam and vast numbers of them were too young to vote. That spring, only 20 and also too young to vote, I campaigned for Senator Eugene McCarthy, an anti-war presidential candidate. That 18, 19 and 20 year olds were not "mature enough" to vote had become the dogma of another closed system that needed another tumultuous bifurcation crisis to crack it open. By 1971, the wisdom of expanding the electorate to include voters 18 and over had become a no-brainer for U.S. elites.

At each step in the expansion of the suffrage, resistance formed to an old closed equilibrium-oriented order defending an ideology of exclusion. The agitators pried the system open by generating nonequilibrium. But the exclusiveness of the newly inclusive system was made more apparent over time by new contenders for inclusion. Each franchise expansion constituted a broader, more diverse, more complex electoral system.

Now, who will create the next voter bifurcation crisis in the United States? 16 and 17 year olds? Prisoners? Non-citizens?

Case 3: Rosa Parks and racial desegregation of public buses

During the Jim Crow era, blacks in places like Montgomery, Alabama had to give up their seats on public buses to whites if all other seats were occupied. The Jim Crow method for seating on public transit in Montgomery followed a strict racial protocol, the inequality evident as whites filled buses up front to back and blacks filling them back to front. Blacks had to pay in the front of the bus then get out and reenter the bus through a door further back. The inequality evident in this ritual came into even sharper relief when only one row remained empty. If at that point a white rider got on the bus and occupied one of the seats in the empty row, the entire row became a row for whites only. A black rider entering the bus at that point would have to stand in spite of any empty seats remaining in that row. If, on the other hand, blacks filled up the last empty row and a white rider got on the bus, all blacks in that row had to vacate their seats to let the white rider sit down. This was the circumstance on December 1, 1955 when Rosa Parks was riding a Montgomery bus.

Political Complexity Model: Racial desegregation of buses

Nonequilibrium political order (organized complexity)

Bus desegregation introduces choice and seating on city busses reflected greater self-organization

Equilibrium-oriented political disorder (disorganized complexity)

Blacks see bus segregation and racial inequality as degrading

Human Mechanization Model

Equilibrium-oriented Political Order	Nonequilibrium Political Disorder
Racially segregated buses based on ideology of white superiority	*Disobedience. Rosa Parks arrested and fined; sparks bifurcation crisis*

The behavior dictated by the Jim Crow culture on public buses shared the mechanistic dynamics of Newtonian order in several respects. For whites who believed in their racial

superiority over blacks, the inequality evident in this machine-like protocol reflected an unquestionable natural order of things. It was a genuine type of order but a mechanistic one. Its participants, like parts of a machine, had to follow a strict, ritual-like script. The premise of absolute certainty characteristic of the mechanical model was embodied in Jim Crow's ideology of white superiority. For A, crossing the color line was tantamount to violating deeply held religious beliefs. For B, under the threat of violence for any insubordination, mechanical obedience and conformity became the norm. As long as all parties obeyed the strictures of Jim Crow, the mechanical equilibrium prevailed.

For blacks who had come to deplore racial segregation, the bus ritual was a degrading experience. The Jim Crow equilibrium was the inverse of order; it was a type of disorder, one that, by denying choice, produced a type of disorganization. Automatically assigning a contested seat to a white and forcing a black to stand was like the two headed coin toss – it raised no uncertainty, it presented no choice, and it reflected zero organization. On that day in 1955 when Rosa Parks stayed put instead of giving her seat up to a white passenger, when she exercised what Frances Fox Piven calls interdependent power or the power to disrupt, she was exposing and calling attention to equilibrium-oriented disorder. At the same time, she introduced uncertainty into a climate of absolute certainty, exercising choice where there had been none, defying the absolute, unquestionable megamechanical order of Jim Crow. In mechanistic terms, she had become a source of far from equilibrium disorder, triggering, of course, the punitive forces aimed at the restoration of Jim Crow order. What else was there to do but to arrest her and book her as a criminal in the local police station?

From a complexity perspective, the year long bus boycott by blacks that followed created a bifurcation or power restructuring crisis whose outcome was to open and socially democratize a closed system. Anyone who enters a public bus in Montgomery today will, I trust, find that seating arrangements are racially equitable and self-organized. With equally exercised power, the question of, say, whether a white person or a black person will get the last empty seat on the bus poses real uncertainty and real freedom of choice regarding a resolution. And, like a regular coin toss, the resolution measures a certain degree of organization.

## Case 4: Latin American probability crossings

The military overthrow of democratically-elected civilian regimes, as occurred in many Latin American countries in the 1960s and 1970s, can be described in terms of probability transitions, or the crossing of probability boundaries – as can the transitions back from authoritarian rule to more open political systems.

Chile

Chilean society, for example, crossed a political probability boundary from the improbable to the probable as a result the 1973 military coup. Draconian measures of political repression instituted after the coup created a climate of fear in which political expression became highly probable relative to what it had been prior to the coup. This was evident throughout Chilean society, particularly in the media and the arts. Newspapers and publishing houses of political opponents were closed down. Books seized in military raids on bookstores, libraries and private residences were burned in public. Many people even destroyed their own books for fear of being caught with them. Newspapers, books, magazines, TV, radio, plays, movies, songs and even poetry became subject to one or another form of censorship. In complexity terms, the

transition from tolerance to intolerance of the improbable is analogous to the shift from an open far from equilibrium thermodynamic system to a closed equilibrium-oriented system (McCullough, 1977).

Political Complexity Model: Transitions from authoritarian rule
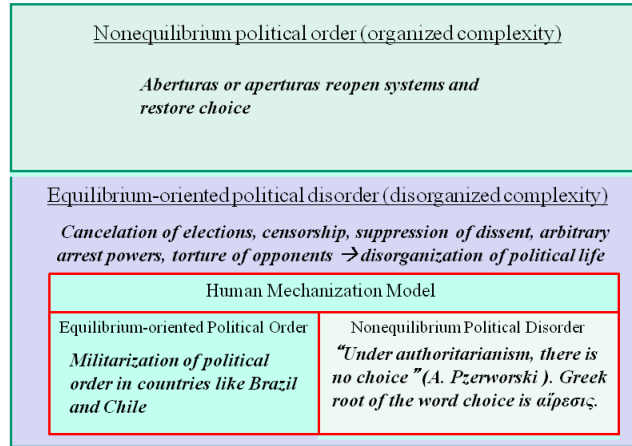
Brazil

Brazilian society crossed a similar probability boundary with the military overthrow of civilian government in 1964, a process that became even more striking when military hardliners staged a "coup within the coup" in December 1968, several weeks after I arrived with the Peace Corps for a stay that would last almost three years. During that time, the military regime regularly produced and displayed propaganda posters all around the country. One of these, I recall, was a simple poster of the Brazilian flag -- but it had one tiny change to the national motto "Ordem e Progresso" which means "Order and Progress". There was an inflection over the "e" thereby changing the "and" to an "is". It read "Ordem **é** Progresso" meaning "Order **is** Progress".

For the military rulers, order was not a mere motto; it was an ideology. Anyone who lived in Brazil at the time can vouch to the monotonous regularity with which the regime publicly portrayed itself as a champion of "order" that had rescued the country from "chaos". And the political order that the dictatorship produced during its 21 years in power was a very real and tangible type of order – but only by mechanistic, equilibrium-oriented standards. The sources of chaos, the disequilibrators, in this clockwork universe were many – the voters not considered "responsible enough" to elect presidents and the editors, students, academics, artists, labor leaders and politicians whose exercise of free expression threatened system equilibrium in the eyes of the military. Suspension of elections, censorship, prohibiting labor strikes, canceling citizenship rights of selected individuals for 10 years (cassação), arbitrary arrest and the systematic use of torture of political opponents were kind of tools needed by the military to chase after its particular Holy Grail of order and equilibrium. From a complexity perspective, however, these measures removed the heart of political life. Their chief effect was to keep citizens disorganized or to disorganize the political system. The political repression effectively pushed the system toward an equilibrium-oriented thermodynamic-like state of closure.

Brazil under military rule offers abundant examples of the disorganizing function of authoritarianism through denial of choice, whether in terms of banning elections or suppressing organized political activity.

Consider the situation of the Brazilian electorate during the 21year reign of the military dictatorship. There were six presidents during that time, all Army generals, all dictated by the Armed Forces, none of whom ever had to face voters in an election. It was as if the military Joints Chiefs of Staff in the United States suspended elections and took it upon themselves the power to appoint the president. For Brazilian voters, it was in other words, a no-choice choice – just like a series of two-headed coin tosses. By analogy, we can say that the imposed choice reflected a state of political disorganization whereas the national elections that have been held since 1985 in the country reflect some state of political organization. This certainly makes sense if we think concretely about the organization of Brazil's electorate. A national electorate which has no choice to make, nothing to do for 21 years, clearly lacks organization. It is incapacitated. An electorate, on the other hand, which has elections to participate in and actually votes in those elections, clearly, by comparison, possesses some qualities of organization.

The analogy applies equally as well to more particular sectors of Brazilian society during that were at the time similarly "disorganized" and to various degrees politically incapacitated by the dictatorship – the mass media which often had to face police censors in editorial rooms (some offending newspapers were forced to pay the salary of the censors), artists whose songs or works in other media were banned, students whose organizations were made illegal, labor organizers whose activities were criminalized and so forth.

Aberturas/Aperturas: System Openings

Since the 1980s, Latin America has experienced a complete transition away from military rule to more open political systems. Over the course of these transitions there were many short-lived openings commonly referred to as *aberturas* in Portuguese or *aperturas* in Spanish. These *aberturas* took place in Brazil on several occasions when military softliners gained the upperhand on hardliners and announced the relaxation of repressive measures like press censorship. Amidst such *aberturas*, there was a tangible sense of relief among journalists, a feeling of being freed from asphyxiating conditions, like coming up for breath after being forcibly pushed under water. But when media outlets tested the military's liberality, publishing, for example, articles about the torture of political prisoners, the censors returned.

Within the proposed schema, these politically repressed systems were thermodynamic-like closed systems, pressed toward an asphyxiating equilibrium-oriented probability, closed to uncertainty recognition (i.e. political questioning). The political aberturas or aperturas -- which eventually became systemic -- were thermodynamic-like openings to far from equilibrium climates, friendly to uncertainty or questioning and favorable to "improbables" like censor-free daily news stories. The aberturas that have managed to persist were bifurcation crises resulting in relatively greater degrees of political self-organization system-wide. The history on these openings and their structural consequences is still far from written, however, as the massive protests in Brazil made clear at this time last year.

Case 5: U.S. national security policies and information dragnet

Some current United States national security policies developed in response to fear of terrorism following the September 11, 2001 attacks appear to fit patterns of an equilibrium-

oriented obsession with predictability. Revelations by former National Security Agency contractor Edward Snowden about current clandestine surveillance activities by the U.S. government suggest official practices marked by a certain degree of absolutism and Manicheanism symptomatic of system closure. As someone who on September 11 was watching through binoculars from my living room as the United Airlines flight number 175 plane struck the second World Trade Tower, I appreciate the real danger posed by terrorism and the need to counteract it. Snowden's disclosures show how these surveillance activities sometimes uncover genuine threats – but they also reveal a host of democratically unaccountable practices in which "power over" threatens to displace "power with".

Consider a recent Washington Post article based on Snowden's leaks. It concludes that "Ordinary Internet users, American and non-American alike, far outnumber legally targeted foreigners in the communications intercepted by the National Security Agency…" The newspaper conducted a four-month review of about 160,000 NSA-intercepted e-mail and instant-message conversations. "[The files] tell stories of love and heartbreak, illicit sexual liaisons, mental-health crises, political and religious conversions, financial anxieties and disappointed hopes. The daily lives of more than 10,000 account holders who were not targeted are catalogued and recorded nevertheless." It is the agency's policy to retain such information even if it has no intelligence value.

Under U.S. law the NSA is only permitted to spy on foreign nationals. Exceptions are allowed if a special surveillance court finds "probable cause" of terrorist ties. Two other programs operate under more lax rules. Analysts are allowed to investigate if they have "reasonable belief" that a target has information of intelligence value and exhibit what was referred to in the NSA exchanges as "foreignness". The paper reported that "One analyst rests her claim that a target is foreign on the fact that his e-mails are written in a foreign language, a quality shared by tens of millions of Americans. Others are allowed to presume that anyone on the chat 'buddy list' of a known foreign national is also foreign." Under these dragnet conditions, the Post report found a "9-to-1 ratio of incidental collection in Snowden's sample." (Gellman et al., 2014)

September 11 and subsequent fears of terrorism created a classic "order versus chaos" bifurcation crisis for the American national security system. The test still posed to the system is how it approaches order. It may, on the one hand, take an equilibrium-oriented approach, one characterized by a thermodynamic-like closure to and intolerance of uncertainty and the unpredictable. On this path, there is "no stone unturned" and an obsessive need to "know it all". It is guided by Manichean standards of "foreignness" and an absolute moral ferocity blind to principles of democratic control. It often appears that those government bodies responsible for assuring this not happen have abdicated their responsibility. Of its four month investigation, the Post reported that "No government oversight body, including the Justice Department, the Foreign Intelligence Surveillance Court, intelligence committees in Congress or the president's Privacy and Civil Liberties Oversight Board, has delved into a comparably large sample of what the NSA actually collects" (Gellman et al., 2014). If, on the other hand, these oversight bodies assert themselves, American democracy has a better chance of passing the test, of maintaining the openness and uncertainty tolerance essential to any democracy.

Thousands of years ago, one complexity thinker, Pericles, said in his memorable Funeral Oration that

"…there is a great difference between us and our opponents in our attitude towards military security. Here are some examples: **Our city is open to the world**, and we have no periodical deportations in order to prevent people observing or finding out secrets which might be of military advantage to the enemy. This is because we rely, not on secret weapons, but on our own real courage and loyalty… **We are capable at the same time of taking risks and of estimating them beforehand**."

Edgar Morin observes that every action in our complex reality involves a gamble because we ultimately have no control over what its effects may be (2008, 53-57). Democracy has always required a significant degree of openness to uncertainty, to the unforeseeable, to the improbable, to the far from equilibrium. It is a gamble. When we refuse to gamble, we refuse to live in a democracy.

Conclusion

A British website called Non-Equilibrium Social Science (2014) is a good indicator of what we can expect to hear more of as complexity science makes inroads into social and political science. But a nonequilibrium approach will do little good if it does not also get to the roots of how power imposed presses individuals, groups and sometimes entire nations toward a stifling and asphyxiating equilibrium. If in this century we succeed in building a nonequilibrium political science that illuminates these debilitating effects of power, then I think we will look back and see that 20th century political science was insufficiently grounded in physical reality, that it did not help us understand that the virtual mechanization of human relationships is not only an abuse of power but a physical disorder. A physically-integrated political science that aligns the human passion for freedom with the indeterminism at the heart of matter can hopefully set us on the path to building genuinely self-organizing social, political and economic structures. In learning how to exercise power with not over others, we can integrate ourselves with the self-organizing pulse of nature.

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    Avon Books.

Appendix: Some Personal Notes on Brazil and Quebec

My current focus on ways to bridge political science and natural science represents a revival over the past several years of a theme I first explored in the 1970s but, for varied reasons, ended up putting on the backburners, even en route to obtaining my doctorate in political science (CUNY, 1995). My personal motivation in pursuing this line of thought stems from having lived in a dictatorship for three years. In late 1968, I arrived in military-ruled Brazil with the United States Peace Corps, just in time to witness what most analysts now consider the most politically repressive period in Brazilian history. After leaving the Peace Corps, I settled in Rio de Janeiro in late 1970 where I became friends with some nationally prominent artists. In frank political discussions, I learned of their Orwellian level of political despair, something akin to what the character in 1984 felt when observing "If you want a picture of the future, imagine a boot stamping on a human face forever". When I returned to the U.S., I was convinced that the dictatorship's obsession with controlling information made the concept of information a key to understanding the dynamics of the dictatorship. I sought out political science studies of information but what I found most useful was a concept originating in the physical sciences, namely Claude Shannon's definition of information as negative entropy. Philosophically and scientifically rooted in the 20th century overthrow of absolute certainty in physics, this concept (Wiener, 1950) struck me as an ideal tool to adapt for criticizing political absolutism and developing a democratic information theory. I pursued these ideas in some graduate work at Stanford. I also published an essay that speculated about the political significance of Shannon's view of information. There I proposed that **"…**dictatorship can be described as the politics of the probable or the politics of entropy and democracy as the politics of the improbable or the politics of negative entropy. Because democratic and dictatorial systems are in these terms respectively analogous to open and closed thermodynamic systems, we may begin to speculate about the possible future development of a science of political thermodynamics**"** (McCullough, 1977). In the process of revisiting these themes in recent times, I have discovered many fresh new efforts underway to bridge the two cultures, largely under the rubric of complexity theory.

Part of my more recent intellectual odyssey involves Quebec. On my last visit here five years ago, my wife and I were vacationing at Villa Massawippi B&B in a room overlooking the beautiful lake of the same name when I made a long overdue discovery. Browsing through a bookshelf in our room, I came across a book published in 1973 entitled Le Paradigme Perdu: La Nature Humaine by an author I had never heard of before: Edgar Morin. I was astounded to find someone referring to a human as "néguentrope par excellence" (1973:228). I knew I had found someone who had been hit by the same lightning bolt. When the owner of the B&B, a former professor at the University of Montreal, discovered how excited I was by the book, he suggested I take it, copy it and mail it back to him. I declined his kind offer and instead acquired a used copy through an Amazon third party as soon as I returned to New York. On a subsequent visit to

Paris, I acquired more of Morin's works, including the six volumes of La Methode (which are still keeping me busy). I thank Professor Alfredo Pena-Vegas, the head of the Centre Edgar
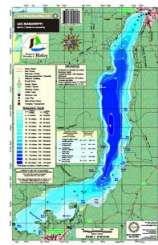
Lac Massawippi, Quebec

"The great disconnect between the natural sciences and the human sciences hides at once the physical reality of the latter and the social reality of the former".

«La grande coupure entre les sciences de la nature et les sciences de l'homme occulte à la fois la réalité physique des secondes, la réalité sociale des premières».

Edgar Morin
La Méthode : La Nature de la Nature, 1977:11

Morin research team that includes Edgar Morin, for a copy of Ciência com Consciência, the Portuguese translation of Science avec conscience. Unfortunately Professor Morin was not present on the day of my visit. When the history of human complexity theory is written, I feel certain Morin will be considered one of its founders, something that Anglophone complexity theorists are slowly discovering as more of his work, much overdue, becomes available in English.