

INTRODUCING COMPLEXITY TO PUBLIC POLICY¹

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The pursuit of order, a desire to comprehend and predict our own world and condition, has been a major part of all recorded human history. For millennia, religion fulfilled the role of providing order in an unknowable universe. The dominant belief in the knowable order of the world and rational and orderly nature of human existence only emerged in the Western philosophical tradition in the Renaissance and Enlightenment. Present critics of human rationality such as post-modernists, constructivists, etc., are easily found and generally accessible. Nevertheless, a belief in the orderly nature and fundamental rationality of society and the ability of traditional scientific endeavour to understand and direct society remains the bedrock of modern natural and social sciences and public policy.

Based on a Sir Isaac Newton's vision of an orderly, clockwork universe driven by observable and immutable laws, it did not take much of an intellectual leap to apply the lessons of the physical sciences to the social realm. Adam Smith and David Ricardo claimed to have captured the laws of economic interaction. Karl Marx wedded his vision of class struggle to an analysis of the capitalist mode of production to create the "immutable" and deterministic laws of capitalist development. Political philosophers such as John Stuart Mill and other utilitarians atomised the world by viewing individuals as rational self-interested actors, while August Comte and the positivists created a vision of scientific society based on order, laws and progress.

With the radical expansion of state powers and exponential growth of international interaction in the 20th century, the pursuit of human order deepened and expanded. In the 1950s, 60s and 70s, this traditional positivist approach permeated the social sciences and public policy thinking to a particularly high level from the modernisation theories of Third World development, the realist vision of international relations, the functionalist interpretation of European integration, to the rational end-state plans of urban planners. The 1980s and 1990s emphasis on 'centralised public management' and the 'targeting and audit culture' are clear developments of these earlier trends. Nevertheless, despite the collapse of the 'laws' in all of these theories and the continued negative impacts of these rigid orderly approaches, social scientists and policy actors are still caught between the desire to seek out new 'laws' or the partial abandoning of the current framework.

¹ This article is based on the co-authored book, Robert Geyer and Samir Rihani, (2010) *Complexity and Public Policy: A New Approach to 21st Century Politics, Policy and Society*, London: Routledge. Permission has been granted by the publisher to use sections from the book.

A theory for moving beyond the limitations of the current Newtonian frame of reference has recently emerged from the physical sciences and is generally labelled Complexity Theory or just Complexity. During the latter half of the 20th century, scientists continued to find physical phenomena that were not amenable to the traditional Newtonian scientific method. Examples included weather patterns, natural evolution, neural networks, the behaviour of metals under extreme temperature conditions, and quantum uncertainty.

At this time the physical sciences began to distinguish between ‘linear’ and ‘non-linear’ phenomena. From a linear or orderly perspective, causes lead to known effects in a predictable and repeatable manner. Systems could be disassembled to understand the behaviour of their constituent elements and then reassembled, clockwork fashion, to model the behaviour of the whole system under differing conditions. From a non-linear or complexity viewpoint, systems are composed of numerous elements that interact locally according to simple rules to maintain simultaneously massive internal variety and global stability. The internal dynamics of the system create complex outcomes that are not amenable to precise prediction. In general, these phenomena clearly reflect the uncertainty and complexity of the majority of social phenomena and experiences.

In essence, it is clear that the natural science based Newtonian paradigm significantly shaped 19th and 20th century social sciences, public policy and the societal pursuit of human order. Since nature was orderly, linear and rational, society should be as well. It was just a matter of time, effort, and will before the true social laws were found and the end-state society was engineered to bring humankind’s history to an end. The horrors of the 20th century’s pursuit of order were the obvious result. However, I believe that the complexity paradigm that emerged in the natural sciences in the 20th century will greatly influence the shape of the social sciences in the 21st century. I want to encourage this transformation because I believe that it lies at the foundation of making the 21st century more humane and peaceful than the 20th.

What is the complexity paradigm?

How and when did it emerge? Is it a hot new academic fad like ‘globalisation’ or the ‘end of history’, or is it something more profound? To begin to answer these questions we need to jump back a few centuries and briefly discuss the emergence of what is commonly labelled as the Newtonian or linear paradigm. For reasons that will become clear, we have called it, the paradigm of order.

The paradigm of order

Although it has been said thousands of times before, it bears repeating, the Enlightenment was an astounding time for Europe. Relatively stagnant and weak and intellectually repressed by the Church during the so-called Dark Ages, intellectual energies released by the Renaissance came to fruition in the Enlightenment. During this time, Europe was reborn and became the centre of an intellectual, technical and economic transformation. It had an enormous impact on the way life is viewed at all levels from the mundane to the profound. Science was liberated from centuries of control by religious stipulations and blind trust in ancient philosophies. Rene Descartes (1596-1650) and, slightly later, Sir Isaac Newton (1642-1727) set the scene. The former advocated rationalism while the latter unearthed a wondrous collection of fundamental physical laws. A flood of other discoveries in diverse fields such as magnetism, electricity, astronomy and chemistry soon followed, injecting a heightened sense of confidence in the power of reason to tackle any situation. The growing

sense of human achievement led the famous author and scientist Alexander Pope to poeticise, “Nature, and Nature’s laws lay hid in night. God said *Let Newton be!* And all was light”. Later, the 18th century French scientist and author of *Celestial Mechanics* Pierre Simon de Laplace (1749-1827) carried the underlying determinism of the Newtonian framework to its logical conclusion by arguing that, “if at one time, we knew the positions and motion of all the particles in the universe, then we could calculate their behaviour at any other time, in the past or future”.

The subsequent phenomenal success of the industrial revolution in the 18th and 19th centuries, which was based on this new scientific approach, heightened confidence in the power of human reason to tackle any physical situation. By the late 19th and early 20th century many scientists believed that few surprises remained to be discovered. For the American Nobel Laureate, Albert Michelson (1852-1931), “the future truths of Physical Science are to be looked for in the sixth place of decimals” (Horgan 1996: 19), implying that physicists were now only filling in the small cracks in human knowledge. More fundamentally, the assumption and expectation was that over time the orderly nature of all phenomena would eventually be revealed to the human mind. Science became the search for hidden order. The universe and everything in it was a magnificent clockwork mechanism.

By and large, that vision of the universe survived well into the twentieth century. In 1996 John Horgan, a senior writer at *Scientific American*, published a bestselling book entitled *The End of Science* which argued that since science was linear and all the major discoveries had been made, then real science had come to an end. Similarly, the eminent biologist and Pulitzer prize winner, Edward O. Wilson argued in his bestselling book *Consilience* (1999) that all science should be unified in a fundamentally linear framework based on physics. The orderly view of the world prospered not only in sciences, but in the fundamental nature of Western social and political life.

To simplify drastically, the paradigm of order was founded on four golden rules:

- Order: given causes lead to known effects at all times and places.
- Reductionism: the behaviour of a system could be understood, clockwork fashion, by observing the behaviour of its parts. There are no hidden surprises; the whole is the sum of the parts, no more and no less.
- Predictability: once global behaviour is defined, the future course of events could be predicted by application of the appropriate inputs to the model.
- Determinism: processes flow along orderly and predictable paths that have clear beginnings and rational ends.

Given the golden rules, several expectations emerged:

- Over time as human knowledge increases, phenomena will shift from the disorderly to the orderly side.
- Knowledge equals order. Hence, greater knowledge equals greater order.
- With greater knowledge/order humans can increasingly predict and control more and more phenomena, including human phenomena and systems.
- There is an endpoint to phenomena and hence knowledge

The orderly paradigm worked remarkably well and was conspicuous by incredible leaps in technological, scientific and industrial achievements. Not surprisingly, success in these areas had a profound effect on attitudes in all sectors of human activity, spreading well beyond the disciplines covered by the original discoveries.

Spreading ripples of doubt

Certainty and predictability for all, the hallmarks of an orderly frame of mind, were too good to last. Fissures had existed for some time, even Issac Newton and Christiaan Huygens in the 17th century couldn't agree on something as fundamental as the nature of light (is it a particle or a wave?). These difficulties bubbled under the surface of acceptable scientific discourse and the expanding university arenas. They were often seen as unimportant phenomena that would be resolved by the next wave of emerging fundamental laws. However, by the early 20th century they could no longer be ignored. The physicist Henri Poincaré (1854-1912) was one of the first to voice disquiet about some contemporary scientific beliefs. He advanced ideas that predated chaos theory by some seventy years (Coveney and Highfield 1996: 169). Later, Einstein's (1879-1955) theory of relativity, Neils Bohr's (1885-1962) contribution to quantum mechanics, Erwin Schrödinger's (1887-1961) quantum measurement problem, Werner Heisenberg's (1901-1976) uncertainty principle and Paul A. M. Dirac's (1902-1984) work on quantum field theory all played a decisive role in pushing conventional wisdom beyond the Newtonian limits that enclosed it centuries before.

The new discoveries did not disprove Newton. Essentially, they revealed that not all phenomena were orderly, reducible, predictable and/or deterministic. What this meant was that even at the most fundamental level some phenomena do conform to the classical framework, others do not. Gravity continued to function and linear mechanics continued to work, but they could no longer claim to be universally applicable to all physical phenomena. They had to live alongside phenomena and theories that were essentially *probabilistic* and had *emergent properties*.

Given these non-linear phenomena and non-adherence to the golden rules of order, new expectations were necessary for this expanding paradigm:

- Over time human knowledge may increase, but phenomena will not necessarily shift from the disorderly to the orderly.
- Knowledge does not always equal order. Greater knowledge may mean the increasing recognition of the limits of order/knowledge.
- Greater knowledge does not necessarily impart greater prediction and control. Greater knowledge may indicate increasing limitations to prediction and control.
- There is no universal structure/endpoint to phenomena/knowledge

Complex systems in the physical world

Once the door was open to probability and uncertainty, a new wave of scientists began studying phenomena that had previously been ignored or considered secondary or uninteresting. For example, one of the earliest people to conceptualise and model a complex system was an American meteorologist, Edward Lorenz. Lorenz developed a computer programme for modelling weather systems in 1961. However, to his dismay due to a slight discrepancy in his initial programme, the programme produced wildly divergent patterns. How was this possible? From an orderly framework, small differences in initial conditions should only lead to small differences in outcomes. But, in Lorenz's programme, small discrepancies experienced positive feedback and reinforced themselves in chaotic ways

producing radically divergent outcomes. Lorenz called this the “butterfly effect”, arguing that given the appropriate circumstances a butterfly flapping its wings in China could eventually lead to a tornado in the USA. Cause did not lead to effect. Order was not certain. Chaos/complexity was an integral part of physical phenomena. Moreover, some phenomena could not be reduced and isolated, but had to be seen as part of larger systems.

This systems approach led to the creation of a variety of definitions of Complex Systems. In the physical world these systems are described as being *complex*, because they have numerous internal elements, *dynamic*, because their global behaviour is governed by local interactions between the elements, and *dissipative*, because they have to consume energy to maintain stable global patterns.

Orderly systems are found at or near equilibrium. A ball bearing inside a bowl is a classic example; it quickly settles at the bottom and that is that. These systems can be very complicated. A jet engine is a wonderfully complicated piece of orderly machinery creating highly predictable physical outcomes that millions of pilots and passengers successfully depend upon every year. Complexity, by contrast, is exhibited by systems that are far from equilibrium. The most dramatic illustration of that process is planet Earth. Without the nourishing rays of energy from the Sun, Earth would perish into complete equilibrium, and therefore nothingness. Continuous supply of energy from the Sun keeps the planet in a highly active state far from equilibrium. The energy is absorbed, dissipated and used to drive numerous local interactions that in total produce the stable pattern that we perceive as life on Earth.

Rules for physical systems in a complexity paradigm:

- *Partial Order*: phenomena can exhibit both orderly and chaotic behaviours.
- *Reductionism and Holism*: some phenomena are reducible others are not.
- *Predictability and Uncertainty*: phenomena can be partially modelled, predicted and controlled.
- *Probabilistic*: there are general boundaries to most phenomena, but within these boundaries exact outcomes are uncertain.

Complex systems in the biotic world

By the latter half of the 20th century, with complexity already deeply penetrating the physical sciences, biologists, geneticists, environmentalists and physiologists also began to consider their respective disciplines within the context of complexity. Analysts in these fields set out to investigate the properties of systems, including human beings, comprised of a large number of internal parts that interacted locally in what looked like a state of anarchy that somehow managed to engender self-organised, stable and sustainable global order. These systems were not only complex, dynamic and dissipative, but also adaptive and display *emergent properties* or *emergence* - reshaping the complex system as a whole and/or the sub-units that make up the system. As Coveney and Highfield argue: “Life is also an emergent property, one that arises when physiochemical systems are organized and interact in certain ways” (Coveney and Highfield 1995: 330).

From this perspective a whole new range of biotic complex systems began to be studied. For example, S. Kauffman (1993) was one of the first to view the genetic code as an evolving complex system. Other concepts like autopoiesis, symbiosis and the *Gaia* system emerged to challenge the orderly framework in the biological sphere.

Golden rules of biotic systems in a complexity paradigm:

- *Partial Order*: phenomena can exhibit both orderly and chaotic behaviours.
- *Reductionism and Holism*: some phenomena are reducible others are not.
- *Predictability and Uncertainty*: phenomena can be partially modelled, predicted and controlled.
- *Probabilistic*: there are general boundaries to most phenomena, but within these boundaries exact outcomes are uncertain.
- *Emergence*: they exhibit elements of adaptation and emergence.

A simple example of a biotic complex system would be the evolution of a species or the interaction of a given plant or animal in a particular ecosystem. A fish in a small pond will evolve and interact with the various food sources (small plants and animals) in the pond to create a stable complex system (such as a stable total number of fish). However, if a change is introduced to the system, a new competitor or food source, the fish may adapt and alter the nature of the system in totally unforeseen ways. Over time, new emergent properties may evolve in the system and/or in the fish itself.

Orderly (modernist) social science and public policy

The success of the orderly paradigm in the natural sciences had a profound effect on attitudes and practices in all sectors of human activity. The social sciences were no exception. Surrounded by the technological marvels of the industrial revolution it did not take much of an intellectual leap to apply the lessons of the physical sciences to the social realm. The English philosopher Thomas Hobbes (1588-1678) used a mechanistic vision to shape an orderly society, a *Leviathan* that would save humans from chaos and civil war. The French economist Francois Quesnay (1694-1774) and the *physiocrates* modelled the economic system on a mechanical clock. The French mathematician, philosopher and revolutionary politician, Condorcet (1743-1794) wrote while imprisoned by the Committee of Public Safety:

The sole foundation for belief in the natural sciences is the idea that the general laws directing the phenomena of the universe, known or unknown, are necessary and constant. Why should this principle be any less true for the development of the intellectual and moral faculties of man than for other operations of nature? (Wilson 1998: 21).

The famous British economist Adam Smith (1723-1790) claimed to have captured the laws of economic interaction while his follower, David Ricardo (1772-1823) believed that some economic laws were “as certain as the principles of gravitation” (Mainzer 1997: 264). Karl Marx (1818-1883) wedded his vision of class struggle to an analysis of the capitalist mode of production to create the “immutable” and deterministic laws of capitalist development. Academics in all the major fields of social science welcomed the new age of certainty and predictability with open arms. Economics, politics, sociology all became “sciences”, desperate to duplicate the success of the natural sciences. Moreover, this desire was institutionalised through the development of modern universities that created and reinforced the disciplinarianisation and professionalisation of the social sciences (Gulbenkian Commission 1996: 7).

The high point of the orderly paradigm was reached in the 1950s and 60s, particularly in universities in the United States. Strengthened by the success of planning programmes during

WWII and the early post-war period, pressured by the growing Cold War, and lavishly funded by the expanding universities, American academics strived to demonstrate, and hence control, the presumed rational nature of human interaction. This traditional Newtonian approach was clearly expressed in the modernisation theories of Third World development, the realist vision of international relations, the behaviouralist writings of sociologists, the positivist foundations of liberal economics and the rational plans of public policy experts and social planners.

Using the Newtonian frame of reference modern social scientists unjustifiably assumed that physical and social phenomena were primarily orderly and therefore predictable. They, consequently, applied reductionist methods founded on the belief that stable relationships exist between causes and effects, such as the assumption that individual self-interest is an explanation and/or a model for national level self-interest. Furthermore, based on this orderly thinking they assumed that society and social institutions had an “end-state” towards which they were evolving. Hence, economic interaction, democracy, fundamental social orders (communism, capitalism, development), etc. all had final stages towards which they were evolving. Nation-states, societies and even individuals could be positioned along this developmental pathway and policies could be devised to help them towards the next level. Orderly social science rested on the same foundation as orderly natural science, treated human beings like orderly atomistic objects and drew similar orderly conclusions.

Unsurprisingly, public policy, resting on a foundation of social science, was equally dominated by the Newtonian vision. In one of the classics in the field, *Seeing Like a State*, the distinguished Yale University professor James Scott categorised a lengthy 19th and 20th century history of large scale public policy blunders by democratic, authoritarian, advanced and developing states. Ranging from plans for mapping cities, resources and populations in Europe and the USA to the disasters of agricultural collectivization in the USSR, villagization in Tanzania and the designed cities in Brasil, Scott notes that:

Radically simplified designs for social organization seem to court the same risks of failure courted by radically simplified designs for natural environments. The failures and vulnerability of monocrop commercial forests and genetically engineered, mechanized monocropping mimic the failures of collective farms and planned cities (Scott 1998: 7)

Scott goes on to note that four factors were essential for the creation of the most grandiose public policy failures. These were: 1) the normal administrative and bureaucratic tools of large scale state institutions, 2) a belief in what Scott calls, ‘high modernist ideology’ that views the ‘rational design of social order commensurate with the scientific understanding of natural laws’ (Scott 1998: 4), 3) an authoritarian state and 4) a weak civil society unable to resist the state’s plans.

In the case of 20th century public policy one can scan through a variety of public policy textbooks to review the predominately orderly/modernist evolution of public policy in the West. Most begin with the illustrious work of Max Weber, later summarised by Talcott Parsons, who mapped out the early contours of the modern state. These included:

- centralised pyramidal administrative hierarchies,
- clear lines of responsibility,
- hierarchical discipline,
- responsibility and decision-making concentrated at the top,
- command and control procedures

- organisational rigidity,
- uniformity and predictability,
- and an ideology of meritocratic technological rationalism.

The so-called British Westminster model is the ultimate example of the type of modernist thinking public policy (Richards and Smith 2002). Demonstrating all of the above factors and more, the British state structures in Whitehall could reasonably be seen to be the model of orderly modernist administration. Presided over by a stable parliamentary system that had only two major parties, many saw the Westminster model as a major achievement in social order and stability. Obviously, other forms of administrative structures abounded in different countries and the Westminster model itself changed over the course of the 20th century. However, its core orderly and modernist elements remained and continued to dominate the functioning of the British state throughout the 20th century.

In terms of public policy thinking the 1980s and 1990s were epitomised by the rise of public choice thinking and new public management. Public choice thinking, founded on the work of the American Antony Downs, was an attempt to bring the rationality and order of neo-classical economics to public policy and public sector actors. For many public choice theorists, public bureaucrats needed to be viewed in the same way as the idealised economic man was in mainstream economics, a rational utility-maximising actor that was not interested in the public good but in the maximisation of their own bureaucratic interests. The problem was that without some form of market to constrain these rational bureaucratic actors they would just keep on demanding more and more resources to increase their ever-expanding administrative empires. For right-wing thinkers in the 1980s public choice thinking provided an explanation for the general rise in state expenditure and public bureaucracies during the 20th century and the means, more markets (implying the sale of state assets and state monopolies) and market-like constraints, for countering the tendency of bureaucratic expansion. However, despite great efforts large state structures and public support for them refused to go away while at the same time integrating markets into state activities produced their own variety of malfunctions.

By the 1990s, public choice theory had metamorphosed into New Public Management (NPM). NPM thinkers wedded the belief in the superiority of the market with a desire to decentralise and increase the flexibility of public administration and policy. However, to justify this decentralisation and flexibility required a radical increase in performance indicators so that the centre could oversee and direct what the local and decentralised actors were doing (Walsh 1995). This focus on efficiency and outputs led to an explosion of public policy targets and the growth of the ‘audit society’ (Power 1997), embraced by both Left and Right. Once again, attempts at creating greater flexibility and variety in the administration and outputs of public policy were undermined by an overriding desire for central control and oversight. Hence, despite huge efforts and a clear understanding of the weaknesses of the traditional orderly Westminster model of public policy, public choice and NPM couldn’t go beyond the existing confines of the traditional framework.

Disorderly (post-modern) social science and public policy

Even at its peak countervailing tendencies in the social sciences survived. There is nothing new about questioning the fundamental order and rationality of human existence. Debates over these issues are easily traced back to Plato and Aristotle. A belief in the fundamentally rational and orderly nature of human existence only emerged in the Western philosophical tradition in the 17th and 18th centuries. During the 18th, 19th and 20th centuries, there continued to be a huge variety of potent critics of the mechanistic view of nature and society and of the

limits of human rationality. In the late 18th century, the German scientist and philosopher, Immanuel Kant (1724-1804) argued that an organism, “cannot only be a machine, because a machine has only moving force; but an organism has an organising force... which cannot be explained by mechanical motion alone” (Mainzer 1997: 83).

These arguments plus the work of Friedrich Schelling (1775-1854) who described an organic “science of living” and the writings of Goethe (1749-1832) who saw the mechanistic model of nature as “grey... like death... a ghost and without sun” (Mainzer 1997: 84) created the foundation of the German romantic philosophy of nature which rejected the mechanism of Newton. In the early 20th century, the hermeneutical tradition of Sigmund Freud (1865-1939) and Max Weber (1864-1920) challenged the belief in the human rational capabilities and the degree to which humans can understand and control their environment and societies.

In the mid-20th century, the American philosopher John Dewey (1859-1952) was advocating his philosophy of pragmatism as a strategy for dealing with the limits of knowledge and uniqueness of human experience while the German sociologists Theodor Adorno and Max Horkheimer were publishing their masterwork, *Dialectic of Enlightenment*, that critiqued the Enlightenment foundations of modernism. In the 1960s the famous Austrian economist F. A. Hayek (1899-1992) argued that: “in the field of complex phenomena the term ‘law’ as well as the concepts of cause and effect are not applicable” (Hayek 1967: 42). By the 1970s, the influential French post-modernist philosopher Jean-Francois Lyotard, in *The Postmodern Condition: A Report on Knowledge* was arguing for an end to all “grand narratives” of Western society. Consequently, from the 1970s onwards as social scientists continually failed to capture the ‘laws’ of society and economic interaction and were continually frustrated over their inability to do so, they began to significantly question the Newtonian framework that underpinned political thinking on the left and right.

Out of this emerged the extremely diverse, but significant challenge of (disorderly) post-modern position in social science. As defined by Terry Eagleton:

Postmodernism... is a style of thought which is suspicious of classical notions of truth, reason, identity and objectivity, of the idea of universal progress or emancipation, of single frameworks, grand narratives or ultimate grounds of explanation. Against these Enlightenment norms, it sees the world as contingent, ungrounded, diverse, unstable, indeterminate, a set of disunified cultures or interpretations which breed a degree of scepticism about the objectivity of truth, history and norms, the givenness of natures and the coherence of identities (Eagleton 1996: vii).

Mirroring these post-modernist criticisms in social science, there has been a wide range of 20th century challengers to the dominance of the orderly public policy framework. In the early 20th century thinkers like Max Weber, though he is well-known for being among the first to describe and analyse traditional administrative and organisational structures, were noting how organisational and institutional structures were capable of altering the underlying rationality of public policy actors to produce misguided and inappropriate outcomes, the so-called ‘iron cage’ of rule based rational control. In his book, *Political Parties* (1911), Robert Michels developed his ‘iron law of oligarchy’ arguing that all organisations become more and more oligarchical as they become larger and more complex. Hence, public policy actors could never directly represent society. The American philosopher John Dewey using his ‘pragmatist’ philosophical approach argued in the 1930s for increasing flexibility and adaptability in US education policy, moving away from centrally determined educational routines that were common at the time. In the 1950s a number of public policy thinkers began

to espouse the theory of incrementalism. This theory argued that due to the growing complexity of modern states and the fundamental uncertainty of public policy actions, one should avoid rigid and detailed large scale plans in favour of evolving incremental actions that can be continuously reviewed and evaluated.

Building on this, Graham Allison, an esteemed Harvard professor, argued that in any major public policy or governmental decision there were three competing and interacting processes at work: rational actions, organisational processes and political dynamics. The recognition of the limits of rational behaviour in large organisations and public administration became so clear that in 1972 Michael Cohen, James March and Johan Olsen postulated that many public decisions were based on a 'garbage can model' of decision-making; confronted with complicated and uncertain problems, policy actors reached into a garbage can of traditional strategies and applied them almost randomly to see if they would work. During the 1980s and 1990s a whole range of political scientists and policy academics began conceiving of public policy as much more of a soft and indirect form of 'governance' rather than firm 'government'. This was particularly embraced by academics studying the messy and contradictory actions and policies of the European Union who then coined the concept of 'multi-level governance' (Hooghe and Marks 1995). In addition to all of these criticisms, a whole range of more radical critiques emerged from gender and race oriented authors arguing that traditional public policy was fundamentally misshapen and distorted by society's gender and racial biases and characteristics.

Complexity and social science

So, how do human beings fit into the complexity paradigm? They are an obvious symbiotic part of the complex web of their physical and biological surroundings. Nevertheless, what makes them distinct from this environment? Their most fundamental difference is consciousness. The ability to ask "who am I?", "How did I get here?", "What does life mean?".

This ability to be self-aware, to understand aspects of the world around them, be aware of their history and to evolve interpretations of themselves, their surroundings and their history makes human beings fundamentally different from all other life forms and physical phenomena. However, this interpretive ability does not produce orderly interpretations. The uniqueness of individual human experience combined with multitudinous possibilities of collective human interaction and the evolutionary nature of human society produce a very high degree of complex interpretive outcomes. This does not imply that there are no universal norms, values or interpretations. For example, a prohibition against murder is a common societal trait. However, the definition of murder, the mitigating circumstances which could surround it and the punishment for the act all vary widely over time and between different societies and cultures.

Rules of conscious systems in a complexity paradigm:

- *Partial Order*: phenomena can exhibit both orderly and chaotic behaviours.
- *Reductionism and Holism*: some phenomena are reducible others are not.
- *Predictability and Uncertainty*: phenomena can be partially modelled, predicted and controlled.
- *Probabilistic*: there are general boundaries to most phenomena, but within these boundaries exact outcomes are uncertain.
- *Emergence*: they exhibit elements of adaptation and emergence.
- *Interpretation*: the actors in the system can be aware of themselves, the system and their history and may strive to interpret and direct themselves and the system.

In essence, complexity theory does not disprove the rationalist orderly paradigm or its antithesis disorder/post-modernism, but acts like a synthesis or bridge between these two and creates a new framework for reconciling these opposing positions. Basically, both the orderly and disorderly frameworks are equally flawed. Both assume that humanity and its relationship to nature are inherently orderly or disorderly when in reality they are both.

For the social sciences if one accepts a complexity framework then one must abandon the rigid divisions and certainties of both modern and postmodern science and recognise the integrative nature of the physical and social sciences. Complexity theory argues that physical and social reality is composed of a wide range of interacting orderly, complex and disorderly phenomena. One can focus on different aspects, orderly (gravity or basic aspects of existence: life/death), complex (species evolution or institutional development) or disorderly (random chance or irrationality) but that does not mean that the others do not exist. Consequently, complexity theory demands a broad and open-minded approach to epistemological positions and methodological strategies without universalising particular positions or strategies. As Richardson and Cilliers argued:

If we allow different methods, we should allow them without granting a higher status to some of them. Thus, we need both mathematical equations and narrative descriptions. Perhaps one is more appropriate than the other under certain circumstances, but one should not be seen as more scientific than the other. (Richardson and Cilliers 2001: 12)

These conclusions, “bridge the old divide between the two worlds (of natural and human sciences) without privileging the one above the other” (Richardson and Cilliers 2001: 11).

More practically, since the 1990s complexity has established footholds in all of the major areas of social science. To name just a few, in philosophy and social theory see Byrne (1998); in economics and management theory see Stacey (1999); in sociology see: Walby (2007); in development theory see: Rihani (2002); in politics and public policy see Geyer (2003 and 2012) and in international relations see Kavalski (2007) and Geyer and Pickering (2011).

Complexity and public policy

Given this relationship between complexity and the social sciences, how would complexity relate to public policy? The problem with this question is that we start to enter unexplored waters. Though there have been a number of recent policy related works, particularly in the field of health, there is no general complexity theory on public policy. Instead, what has been emerging since the 1990s has been a blossoming of complexity based works in a variety of policy sub-areas. Examples include work on social policy by authors such as Blackman (2006); in education policy, Haggis (2007); economic policy Beinhocker (2005); in health policy Sweeney (2006) to name just a few.

All of this activity shows how quickly complexity has moved from the fringes of social science theory to the day-to-day of policy decision-making. Building on these works one can identify a simplified version of a complexity approach to policy.

The foundations of a complexity public policy

Theoretical basis

- Partial order
- Predictability and uncertainty
- Emergence
- Reductionism and holism

- Probabilistic
- Interpretation

Expectations

- Over time human knowledge increases, but physical, biological and human phenomena are unpredictable and evolve into new patterns within general boundaries. Policy actors can know more, but the systems they are observing do not stand still, are unpredictable within general boundaries and are constantly evolving and reinterpreting themselves.
- Knowledge is powerful and useful and more knowledge can be more powerful and more useful. However, due to the fundamentally unpredictable, probabilistic, emergent and interpretive nature of human existence, there is no way for policy actors to know the final order. Knowledge is always limited and learning never stops.
- Greater knowledge does not guarantee greater prediction or control. Policy actors with greater knowledge must constantly recognise the limits of their knowledge and must act democratically rather than in an authoritarian fashion.
- There are general boundaries to all phenomena, but a huge and evolving range of variation and emergence within those boundaries. No endpoint but a continual search for policy change within a bounded but emergent framework.
- There is no fundamental hierarchy of knowledge or methods in the social sciences. However, certain policy methods are more appropriate for some phenomena than others.

Implications

- Policy actors must take an open-minded and flexible approach to the orderly and disorderly foundations of all phenomena.
- There are continual bounded and emerging limits to human knowledge and public policy despite the exponential increase in evidence/data.
- Policy actors can obtain some degree of predictive and experimental results, but must often combine them with uncertainty and interpretation, at best, probabilistic strategies.
- Recognising the strengths and weaknesses of quantitative/qualitative methodological or evidence based and interpretive strategies and balancing them against each other is the primary methodological strategy for supporting reasonable public policies.
- Creation of an understanding of fundamental boundaries combined with an acceptance of continual discovery and openness is the ultimate goal. The key isn't to find the final order and implement it, but encourage the actors in the policy area to adapt and adjust to the continual evolutionary changes.

Vision of history and progress

- At best, policy actors can pursue a continual balancing of probabilities in a bounded evolving situation. Enabling local actors to maximise their complexity within a stable framework creates the greatest likelihood for healthy evolution and adaptation. Exact and detailed policy prescription is extremely limited (except when discussing the fundamental aspects of the policy framework).

Conclusion and implications for Chinese public policy

What I have tried to do in this brief article is summarise the dominant perspective of 20th century Western public policy, explore the major challenger to this position, postmodernist/disorderly perspective, and argue that neither fully captured the complex reality of everyday policy-making. From here, I argue that the only way to move forward from these two positions would be build up from a complexity perspective, a new paradigmatic world view of science and society that combines both order and disorder. As argued by myself and many others, we believe that complexity can help to shape a better

understanding of nature and society, avoid some of the more extreme policy mistakes of the 20th century and lay the foundation for more humane and peaceful policies in the 21st.

Finally, though my knowledge of China is extremely limited (I have only recently had the opportunity to visit China and only briefly studied its 20th century history), I feel that many of the concepts of complexity mirror elements from classical Chinese philosophy (balance, tension, change) and that there are many interesting crossovers. For example, an early Western exponent of complexity, the well-known physicist Prof. Fritjof Capra titled his first book, *The Tao of Physics* and interwove a number of classical Chinese philosophical concepts into his theoretical framework. Moreover, like the UK, China is going through a major review of its policy structures and approaches. Perhaps a complexity framework may allow for a new and deeper connection between Western and Chinese policy thinking and policy making. The possibilities are enormous.

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