Chapter 10

The Complexity of Social Systems: Could Hegemony Emerge from the Micro-Politics of the Individual?

David Kreps

Introduction

Critical philosophies of social systems have often borrowed from scientific insights into non-social systems (though admittedly with mixed results – see Mirowski 2002; Curtis 2011). General Systems Theory, after somewhat Parsonian (1951) beginnings, has, in recent decades, taken a revealing turn, led by environmental biology, capturing the imagination of a growing number of sociologists with the notion of Complex Adaptive Systems – or put simply, a notion of complexity that is distinct from that which is merely complicated. To use Paul Cilliers's marvellous example: 'I have heard it said (by someone from France, of course) that a jumbo jet is complicated, but that a mayonnaise is complex' (Cilliers 1998: 3). This poses interesting questions for the focus of this volume.

What if there were a suitably Gramscian totalizing – and scientific– approach to understanding social systems, which nonetheless escaped all the reductionist, scientistic pitfalls a deconstructive and poststructuralist Foucauldian would be wont to point out? What if there was a science that could speak coherently about the macro-level of social structures without denying the radical uncertainty at the micro-level of the individual, a theory which supported the tension between radical contingency and free choice at the level of the individual yet was able simultaneously to discern and predict robust and reliable patterns at the level of the collective? What if, in a non-mystical sense, the whole really is greater than the sum of its parts – that a complex whole can 'exhibit collective properties, "emergent" features that are lawful in their own right'? (Kaufmann 1995: viii). Would this science of complexity not grant us a context in which the ideas of both Foucault and Gramsci could sit, no longer conflicting because both contextualized by their new situation? Could not Foucault's micro-politics in society indeed add up to and constitute the central figure of a State that exhibited patterns not dissimilar to Gramsci's descriptions of the hegemonic reach of that centre out into the minutiae of social relations?

As an afterword to this volume, then, I wish the reader to indulge me in an attempt to explore this possibility – albeit only tentatively – as an introduction to the substantive work that would need to follow should the premise outlined in this final chapter be deemed worthy of exploration. First, we must briefly explore what this 'complexity' theory is about.

The Complexity Turn

In the 1990s – during the decade following Foucault's death – the work of Stuart Kaufmann (1995; 2001) became known outside his highly specialized field, through his very accessible books, *At Home in the Universe* (1995) and *Investigations* (2001). Building on the insights of Ilya Prigogine (1977; 1984) and paralleling the ideas of Brian Goodwin (1994), Kaufmann's is a view based upon modern biology, and yet reaching out far beyond it, challenging the reductionist neo-Darwinian orthodoxy of the likes of Richard Dawkins (1989), presenting a new understanding of evolutionary theory that places natural selection as a *secondary*, rather than primary force. The primary force behind evolution, for Kaufmann, is self-organization. This is not a new idea in philosophy, but certainly radical for the twentieth-century science of biology. For Kaufmann, 'Life and its evolution have always depended on the mutual embrace of spontaneous order and selection's crafting of that order' (Kaufmann 1995: 9). Yet these insights into how patterns in the branching of evolution reveal a lawful ordering, how the complexity of teeming variety harbours principles of self-organization, he also extends – as perhaps is often the wont with some popular scientists, but in this case extremely plausibly – beyond the self-organization of flora and fauna. 'The natural history of life may harbour a new and unifying intellectual underpinning for our economic, cultural, and social life' he asserts (Kaufmann 1995: 15). He suspects that 'the fate of all complex adapting systems in the biosphere – from single cells to economies – is to evolve to a natural state between order and chaos, a grand compromise between structure and surprise' (1995).

Acknowledging the march of physics towards a final theory of everything, he nonetheless reminds us that though it may end up explaining how the building blocks of the universe operate, it 'almost certainly will not predict in detail' (Kaufmann 1995: 16). This failure to predict is down to two fundamental branches of physics itself: quantum mechanics, 'which assures a fundamental indeterminism at the quantum level' with all its attendant macro-scopic consequences, and chaos theory, neatly captured in the famous so-called ‘butterfly effect’ that can see the flapping of a butterfly’s wings in Australia cause a hurricane in the Atlantic (Kaufmann 1995: 17). But not knowing the details does not preclude us from building theories that ‘seek to explain the generic properties’ – for example, ‘when water freezes, one does not know where every water molecule is, but a lot can be said about your typical lump of ice’ (1995). Kaufmann attempts to develop, through his work, ‘classes of properties of systems that … are typical or generic and do not depend on the details’ (1995). Giving numerous examples, from the origin of life ‘as a collective emergent property of complex systems of chemicals’ through to ‘the behaviour of coevolving species in ecosystems that generates small and large avalanches of extinction and speciation’, Kaufmann finds that the ‘order that emerges depends on robust and typical properties of the systems, not on the details of structure and function’ (Kaufmann 1995: 19). To grasp how seemingly random connections among discrete and previously isolated units can generate staggering order, Kauffman reduces the notion of complexity to a very simple metaphor with buttons and threads.

> “Imagine 10,000 bottoms scattered on a hardwood floor. Randomly choose two buttons and connect them with a thread. Now put this pair down and randomly choose two more buttons, pick them up, and connect them with a thread. As you continue to do this, at first you will almost certainly pick up buttons that you have not picked up before. After a while, however, you are more likely to pick at random a pair of buttons and find that you have already chosen one of the pair. So when you tie a thread between the two newly chosen buttons, you will find three buttons tied together. In short, as you continue to choose random pairs of buttons to connect with a thread, after a while the buttons start becoming interconnected into larger clusters…. A phase transition occurs when the ratio of threads to buttons passes 0.5. At that point, a ‘giant cluster’ suddenly forms…[as] most of the clusters have become cross-connected into one giant structure.”(Kauffman 1995:56)

Phase transitions are key, too, to many biological systems. As Goodwin describes, the single-celled organisms, or amoebas, in cellular slime mould, a very primitive life-form, have two distinct phases to their life cycle. Whilst food in the form of bacteria is available the amoebas exist as independent, single cells, crawling about on their hunt for and consumption of food. As single-celled organisms, their reproduction consists in growth and division, and during this phase they seem to pay little if any heed to one another. This is in sharp distinction to the second phase of their cycle. Once the food runs out, the amoebas start to signal one another, releasing a chemical that constitutes communication from cell to cell. The release of the chemical creates a centre to which cells receiving the signal start to move – at the same time also releasing a burst of the chemical themselves. In laboratory conditions, in a petri dish, these movements quickly form complex and beautiful spatial patterns. This aggregation, moreover, then morphs gradually into a multicellular organism:

> "the initially simple aggregate of cells becomes progressively more complex in form, and the cells in different positions differentiate into specific cell types. The final structure consists of a base, a stalk that rises up from the base, and on top a 'fruiting body' made up of a spherical mass of spores that can survive the absence of food and water. When conditions recur that allow growth, the spores are released from the fruiting body and germinate – each one producing an amoeba that feeds, grows, and divides – and the life cycle starts again." (Goodwin 1994:47)

In this way the theory of complexity – and its attendant principles of self-organization – is not tied to simple computational aggregations such as the buttons and thread example, nor merely the world of biology as in the cellular slime mould example above, but capable of evincing patterns in all manner of complex adaptive systems – like the social and political worlds that are the focus of Gramsci and Foucault.

In 1998, Paul Cilliers took the next logical step, with his ground-breaking book, *Complexity and Postmodernism*, in which he lays out the many and varied confluences between – in particular Derridean, deconstructive – poststructuralist thought, and this new science of complexity. By 2005, an entire special issue of *Theory, Culture and Society* – including a new essay from Cilliers – was given over to consideration of the Complexity Turn in which sociological thought was beginning to absorb the impact of these new ideas (Urry 2005).

Cilliers's (1998) intervention on complexity theory concentrates on neural networks and poststructuralist thought. Cilliers lucidly points out a fundamental issue that must be grasped about complexity:

> It is useful to distinguish between the notions of 'complex' and 'complicated'. If a system – despite the fact that it may consist of a huge number of components – can

> be given a complete description in terms of its individual constituents, such a system is merely *complicated.* Things like jumbo jets or computers are complicated. In a *complex* system on the other hand, the interaction among constituents of the system, and the interactions between the system and its environment, are of such a nature that the system as a whole cannot be fully understood by analysing its components. Moreover, these relationships are not fixed, but shift and change, often as a result of self-organisation. This can result in novel features, usually referred to in terms of *emergent properties.* The brain, natural language and social systems are complex. (Cilliers 1998: viii)

There are important differences in approach that must be undertaken between studying something which is complicated, and something which is complex. The analytical method, whilst useful for complicated systems, is counterproductive when trying to understand complex systems. Complexity focuses on the shifting and evolving 'intricate *relationships*' between components. 'In "cutting up" a system, the analytical method destroys what it seeks to understand' (Cilliers 1998: 2). Furthermore, interactions are not restricted to being *physical* – they can also be described as 'transference of *information*' (Cilliers 1998: 3). These interactions are both *rich* – 'any element in the system influences, and is influenced by, quite a few other ones', and *non-linear* – 'small causes can have large results, and vice versa. It is a precondition for complexity' (Cilliers 1998: 3).

These rich, non-linear information exchanges, moreover, are short-range, resulting in the phenomenon of recurrency. Information being received primarily from each components' immediate neighbours can go through many 'hops', resulting in wide-ranging influence, and there can be 'loops in the interactions' – activities can affect themselves through direct feedback or after a number of intervening stages (Cilliers 1998: 4). Such 'feedback' can be *positive* (enhancing, stimulating) or *negative* (detracting, inhibiting). Both kinds are necessary.

Complex systems 'are usually open systems, i.e. they interact with their environment'. By contrast, 'closed systems are usually merely complicated' (Cilliers 1998: 4). This is of crucial significance in environmental theory, where for much of the twentieth century – at least since Tansley (1935) – a nineteenth-century organicist metaphor of natural equilibrium has been the defining characteristic of the term Tansley coined, 'ecosystem'. Yet, as many ecologists in the last decade or so of the twentieth century found through painstaking study (see Hagen 1992; Botkin 1992), the natural world in fact displays no such equilibrium at all, and the notion of ecosystems has undergone a radical rethink. As Cilliers notes, 'Complex systems operate under conditions far from equilibrium. There has to be a constant flow of energy to maintain the organisation of the system and to ensure its survival. Equilibrium is another word for death' (Cilliers 1998: 4).

This constant flow of energy was first described by Ilya Prigogine (1984: 143), who coined the term 'dissipative structure' to describe systems that are sustained by the persistent dissipation of matter and energy. As Kaufmann asserts, 'in dissipative systems, the flux of matter and energy through the system is a driving force generating order' (Kaufmann 1995: 21). The image of a whirlpool of water at the plug-hole in a bathtub is a useful illustration. If the tap is left running, the whirlpool persists, bringing order to the constant flow of water (Goodwin 1994: 10). It is here, in this inherently unstable nonequilibrium, where, according to Kaufmann, 'life exists at the very edge of chaos' (Kaufmann 1995: 26). Living cells are themselves 'nonequilibrium dissipative structures', and the very nature of evolution – and especially of the coevolution of many systems, such as species in an environment – is to attain the 'edge of chaos, a web of compromises where each species prospers as well as possible but where none can be sure if its best next step will set off a trickle or a landslide' (Kaufmann 1995: 29).

But as Cilliers is at pains to underline, for all this chaos and flux, these remain discernible systems, with pattern and order. As he asserts, 'complex systems have a history. Not only do they evolve through time, but their past is co-responsible for their present behaviour' (Cilliers 1998: 4).

Unlike merely complicated systems, susceptible to analysis, this order does not arise through the control of one part of the system over another.

> Each element of the system is ignorant of the behaviour of the system as a whole, it responds only to information that is available to it locally. This point is vitally important. If each element 'knew' what was happening to the system as a whole, all of the complexity would have to be present in that element. (Cilliers 1998: 4)

The reader will undoubtedly by now be sharing my fascination with the possibilities of applying this notion of complexity to the understandings of both Gramsci and Foucault.

Cilliers takes his readers through a fascinating tour of how this breakthrough in scientific theory not only challenges the reductionist analytical approach of previous scientific endeavour, but that poststructuralist thought 'is sensitive to the complexity of the phenomena under consideration' (Cilliers 1998: 22) in a range of ways he devotes his book to explaining. In particular, he rehearses Derrida's argument against the theory of representation – so crucial to much of analytical thought – stressing that Derrida's 'argument against representation is not anti-scientific at all. It is really an argument against a particular scientific strategy that assumes complexity can be reduced to specific features and then represented in a machine. Instead', Cilliers continues, 'it is an argument for the appreciation of the nature of complexity, something that can perhaps be "repeated" in a machine, should the machine itself be complex enough to cope with the distributed nature of complexity'.

Though, of course, 'Whether our technology can manufacture such a machine remains an open question' (Cilliers 1998: 86). As Kaufmann asserts, the fundamental problem with reductionist thought when applied to complex systems is that to represent a complex system one must, of necessity, reproduce the system in its entirety. The representation, usually something like an algorithm – the 'shortest description' which can capture the essential elements of a system – can only capture the entirety of a complex system, because a complex system is already its own shortest description. In computation this is known as an 'incompressible algorithm' (Kaufmann 1995: 22).

Complexity, Gramsci, and Foucault

So where does the Complexity Turn lead us in our consideration of Gramsci and Foucault? By now it will be clear to the reader that the criticisms of Gramsci levelled by Laclau and Mouffe (Torfing 1999:36), who see a nineteenth-century Marxist essentialism at the core of Gramsci's work, are accepted by this author, whose sympathies lie with the Foucauldians and other poststructuralists, on this issue. Despite Morera's suggestion that Gramsci's Marxism carried the germ of a postmodernism deeply sceptical of the "possibility of objectivity" (Morera 2000:18) - an anti-scientistic and anti-positivist stance derived from the work of Benedetto Croce - it is apparent that compared to Foucault's epistemic stance on the issue, Gramsci's "absolute historicism", as it comes across in his critique of Croce in Notebook 10, is a far more realist position.(Gramsci 2007:371) But can the insistence of the Gramscians on an objective, scientific basis for political science be satisfied with this newly complex evolutionary biology and its implications for complex systems of all kinds? Although – as Demirovic reminds us, in this volume, for Foucault, 'The precision of theory, its scientific character, was an entirely secondary question' (Foucault 1980: 137), I believe this is nonetheless a very promising avenue for research. Moreover, the nominalism of Foucault, and his inability to see beyond the individual and conceptualize social structures and institutions as collectivities, can similarly be overcome by complexity theory without reducing the details – the individuals and practices that make up such structures – to mere component parts of a mechanistic system. The individual 'responds only to information that is available to it locally' (Cilliers 1998: 4).

Now, there is a long history of metaphors used for understanding the world of the social, borrowed from scientific endeavour. Such a practice does indeed have its detractors, and in particular authors such as Peter Stewart (2001) single out complexity theories as having 'limited use in the study of society', because 'social processes are too complex and particular to be rigorously modeled in complexity terms' (Stewart 2001: 323). Indeed, this author is keen to distance the ideas represented in this chapter from the approach, say, of Luhmann, whose work is one of the more advanced amongst social complexity theorists, but 'can be seen in part as a development of the functionalist theories of Parsons' (Stewart 2001: 326). Luhmann's embrace of Maturana's closed cybernetic 'autopoiesis' runs counter to the open nature of truly complex systems. (Padgett 2012: 33)

But such metaphors are useful, particularly with relevant scholarship, as even Stewart (2001) asserts: 'Social processes and phenomena are far too complex for complexity theory to deal with, or profoundly elucidate, without the aid of the resources of the better of existing social theories and studies' (Stewart 2001: 353). We should be on safe ground with Gramsci and Foucault, then.

So, if in the Middle Ages man and his world were understood in light of the metaphor of the clock, and in the nineteenth century the new mechanics made this clockwork all the more complicated and steam-driven, then in the late twentieth century it came as no surprise that people and societies should begin to be understood by the metaphor of the computer. Yet, as Cilliers stresses, 'our technologies have become more powerful than our theories' (Cilliers 1998: 1), and, as Kaufmann points out, it turns out that in fact the 'theory of computation seems to imply that nonequilibrium systems can be thought of as computers carrying out algorithms. For vast classes of such algorithms, no compact, lawlike description of their behaviour can be obtained' (Kaufmann 1995: 23); there being no shorter description, in other words, than the system itself, and evolution itself being just such an incompressible algorithm.

Thus the disciplinated world Foucault paints for us, in which the micro-politics of power relations codetermines our subjectivities within overlapping epistemes of discursive practices, can, in complexity terms, begin to be envisaged as an incompressible algorithm – the shortest description possible of a highly complex constantly shifting system of interpenetrating open systems. Indeed, the 'global', as John Urry points out (2005), 'is comprised of various systems, operating at various levels or scales' and 'each constitutes the environment for each other. Thus criss-crossing "societies" are many other mobile, material systems in complex interconnection with their environments' (Urry 2005: 11). If this picture is accurate, then with the help of Kaufmann's theories, and those of others working in the field of complexity, it may well be possible to evince generic lawlike behaviours in these systems not dissimilar to those attempted by Gramsci. Such patterns would not – could not – be detailed, as Cilliers points out, in his essay in 2005:

> In describing the macro-behaviour (or emergent behaviour) of the system, not all the micro-features can be taken into account. The description is a reduction of complexity. Nevertheless, macro-behaviour is not the result of anything else but the micro-activities of the system. Yet, to describe the macro-behaviour purely in terms of the micro-features is a difficult task. When we do science, we usually work with descriptions which operate mainly on a macro-level, but these descriptions will, more often than not, be approximations of some kind. (Cilliers 2005: 258)

Armed with such approximations of a newly *complex* Gramscian political science, the project of social change might finally overcome the paralysis poststructuralism can be accused of having brought upon it.

Could this metaphor of complexity be useful for bridging the divide between Gramsci and Foucault? Is this indeed a way in which the 'fundamental classes' (labour and capital) might better be reconceived, escaping the essentialism imputed to them even by Gramsci, and aligning them more closely with the new conception of politics to be derived from Foucault? Could hegemony emerge from the micro-politics of the individual? There is clearly much work to be done before such an assertion can be made, and this chapter seeks merely to suggest it as a possibility for further exploration.

As Byrne (2005) concludes, there are some crucial approaches in the social sciences that must be undertaken for this work to begin. Beyond the merely metaphorical apparatus I have presented above, complexity theory will need to become the 'frame of reference' that 'shapes the actual tools of investigative social science themselves' if this project is to have real impact (Byrne 2005: 96). Byrne also asserts that the comparative method in the social sciences will need greater emphasis, firstly 'since recognition of complex causation has always been a foundation of the comparative approach', secondly since 'serious quantitative investigative tools' are beyond the 'limitations of many social scientists', and thirdly because 'the comparative method employed at the level of neighbourhood and city region has very considerable potential for informing the participatory process in policy formation and implementation – for serving as a basis for what is actually an ongoing process very little noticed by social theorists but one with very considerable implications for the nature of politics in post-democratic societies' (Byrne 2005: 96).

Brian Castellani and Frederic Hafferty have, in 2009, published a book on how Foucault (at least) can be used to build a theory of social complexity, *Sociology and Complexity Science: A New Field of Inquiry* (2009). Here they focus on Foucault's interest in trying to understand how social systems change from one state to another – from one set of self-organizing relations to another – and suggest that Foucault's work could be characterized as a study of phase transitions, or tipping points, such as that between amoebas and cellular slime mould, as mentioned above, or from judicial punishment to disciplinary punishment, from taking care of the self to knowing the self, and so forth. They suggest that this is in fundamental respects what Foucault's entire discourse is about, as well as with the inevitable impact these systems and state changes have upon individuals and the care of the self.

How the ideas of Gramsci might fit into this frame remains to be seen. My task here is to suggest that if there are – as this volume seeks to prove – substantive confluences between the work of Foucault and Gramsci that provide us with a far better picture of society and the relationship between the group and the individual than either does on their own, then, given the new interest in how Foucault's work can be seen through the lens of complexity, discovering how complexity theory and the ideas of Gramsci interrelate may well prove to be very fruitful work.

Gramsci's primary concept, hegemony, as we have seen in the Introduction to this volume, understood as involving the articulation of social identities in the context of social antagonism, provides us with an articulation of identity that 'is taken to be conditioned by the deconstruction of the very notion of structure, which reveals the discursive, and thus the contingent, character of all social identities' (Torfing 1999: 14). This reconceived hegemony, moreover, is situated in a far more nuanced social understanding than the traditional Marxist base-superstructure model. As Torfing relates,

> we should conceive of the state, economy and civil society as articulated within a relational totality which has no pregiven centre, and which thus allows for different and shifting relations of dominance between its constituent parts. According to Laclau, (1981:53) such a conception is precisely what Gramsci aims at with his notion of historical bloc. (Torfing 1999: 28)

The historical bloc is a concept Gramsci defines as a 'complex, contradictory and discordant *ensemble*' of the institutional orders of state, economy and civil society (Gramsci 2007: 366). This is indeed very close to Urry's description, in considering the Complexity Turn, of the global as 'criss-crossing "societies" [that] are many other mobile, material systems in complex interconnection with their environments' (Urry 2005: 11).

Certainly the essentialist remnant in Gramsci's thought, as Torfing describes it, which whilst recognizing the political character of the economy continues to grant it a final say in all matters, has to be jettisoned if this reading of the concept of historical bloc provided by Laclau and supported by Torfing is to be accepted. As Torfing notes, examining the original Marxist definition, 'far from constituting a homogenous social sphere from which all traces of politics have been removed, the economy is heterogeneous terrain for political struggles' (Torfing 1999: 38). Accepting this, as Gramsci did, one must today also accept, in the light of poststructuralist discourse theory, that indeed nothing in society is purely infra- or superstructural, but profoundly interpenetrated, coevolving, and *complex.* Indeed, following this line of thought, one discovers that the fact that discourse is not fixed or inevitable actually provides the possibility for power, and for hegemonic practices within the historical bloc. Hegemonic practices, meanwhile, are situated within, and constitute, discourse. 'Hegemony and discourse are *mutually conditioned* in the sense that hegemonic practice shapes and reshapes discourse, which in turn provides the conditions of possibility for hegemonic articulation' (Torfing 1999: 43).

Now, if language – and discourse – is understood as a self-organizing complex system, (Cilliers 1998: 125) the conditions of possibility for hegemonic articulation become likewise susceptible to complexity theory. It seems that there is plenty of work linking complexity theory and poststructuralism – Cilliers as the prime example, but also work linking complexity and Foucault. There seems, in the extant literature I have been able to find, a dearth of any thinking linking complexity and Gramsci. Bogdanov, however, a founding member of the Bolsheviks, is credited with inspiring Bertalanffy's systems theory and the later complexity theory with his 'tektology' notions, and, Gare claims, Gramsci, too 'was probably influenced at least indirectly by Bogdanov'. There may indeed be fruitful possibilities for linkage here.

A Twenty-First-Century Research Programme

In sum, the principle arenas of confluence and dissonance between the two oeuvres of Gramsci and Foucault for twenty-first-century consideration, and thereby perhaps the importance and timeliness of this new volume offering a reassessment of the relationship between the two writers, may indeed lie within the purview of the sociology of complexity.

Complexity theory may enable political thinkers, critical philosophers and sociologists to heal the late twentieth century rift in radical thought between predominantly Marxist-based political thought, in the one camp, and the poststructuralist cadre almost defined by the distrust of what they viewed as the other's essentialism. This would bring both kinds of radical thinkers together into a new domain neither as scientistic as the worst of the one nor as myopic as the worst of the other. An end to this rift would not only help to remove the stigma associated with the concept of socialism, but also help to lift the paralysis associated with the radical uncertainty and contingency of the postmodern. This new rapprochement, moreover, would bring the technicians of computational social science and the localism of the ethnographic community into meaningful conversation with critical philosophy and political science, enabling the creation of widely consensual and robust recommendations for progressive social policy – recommendations perhaps only the worst demagogues of the Right would be free to ignore.

References

Botkin, D. 1992. *Discordant Harmonies* Oxford: Oxford University Press

Byrne, D. 2005. Complexity, configurations and cases. *Theory, Culture & Society* 22(5): 95–111.

Castellani, B. and Hafferty, F.W. 2009. *Sociology and Complexity Science: A New Field of Inquiry*. London: Springer.

Cilliers, P. 1998. *Complexity and Postmodernism*. London: Routledge.

Cilliers, P. 2005. Complexity, deconstruction and relativism. *Theory, Culture & Society* 22(5): 255–67.

Curtis, A. 2011. *All Watched Over By Machines of Loving Grace.* London: BBC.

Curtis, A. 29 May 2011. *How the 'Ecosystem' Myth has been Used for Sinister Means.* London: The Observer.

Dawkins, R. 1989. *The Selfish Gene.* Oxford: Oxford Paperbacks.

Foucault, M. 1980 [1991]. *Remarks on Marx: Conversations with Ducio Trombadori*. New York: Semiotext(e).

Goodwin, B. 1994. *How the Leopard Changed his Spots.* Princeton, New Jersey: Princeton University Press.

Gramsci, A. 2007. *Selections from the Prison Notebooks*, edited and translated by Q. Hoare and G.N. Smith. London: Lawrence and Wishart.

Hagen, J.B. 1992. *An Entangled Bank.* New Jersey: Rutgers University Press.

Kaufmann, S. 1995. *At Home in the Universe.* Oxford: Oxford University Press.

Kaufmann, S. 2001. *Investigations.* Oxford: Oxford University Press.

Laclau, E. 1981. Teorias marxistas del estado: Debates y perspectivas. In *Estado y Poltíca en América Latina*, edited by Lechner, N., Mexico: Siglo XXI, 25–59.

Mirowski, P. 2002. *Machine Dreams: Economics Becomes a Cyborg Science.* Cambridge: Cambridge University Press.

Morera, E. 2000. Gramsci's critical modernity. Rethinking Marxism 12(1): 16–46.

Padgett, J.F. (2012) "Autocatalysis in Chemistry and the Origin of Life" in John F. Padgett and Walter W. Powell (2012) *The Emergence of Organizations and Markets* Princeton, N.J.: Princeton University Press

Parson, T. 1951 [2001]. *Toward a General Theory of Action.* London: Transaction Publishers.

Prigogine, Ilya. and Nicolis, G. 1977. *Self-Organization in Non-Equilibrium Systems*. London: Wiley.

Prigogine, I., and Stengers, L., (1984) *Order Out Of Chaos.* London: Flamingo

Stewart, P. 2001. Complexity theories, social theory, and the question of social complexity. *Philosophy of the Social Sciences* 31: 323–60.

Tansley, A. 1935. The use and abuse of vegetational concepts and terms. *Ecology* 16(3): 284–307.

Torfing, J. 1999. *New Theories of Discourse: Laclau, Mouffe and Zizek.* Oxford: Blackwell.

Urry, J. 2005. The Complexity Turn. *Theory, Culture & Society* 22(5): 1–14.