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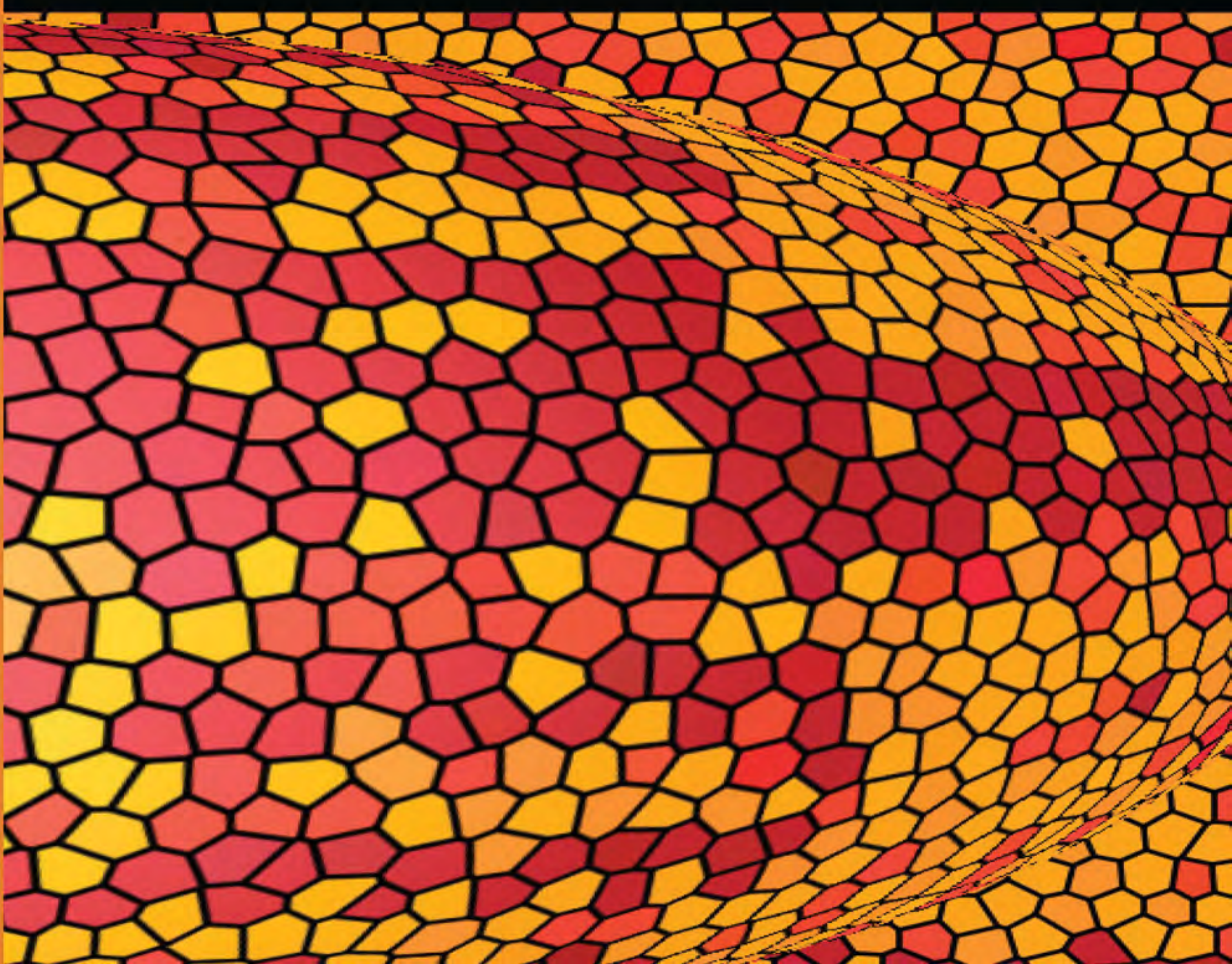
2010 Annual

Volume 12

Edited by
Peter M. Allen , Kurt A. Richardson, and
Jeffrey A. Goldstein



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Editorial

Peter M. Allen
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This annual demonstrates clearly the enormous variety of subjects and issues that are now encompassed by complexity and complex systems thinking. From philosophical issues of the limits to knowledge, through models of networks and interacting agents, to issues of organizational emergence and learning, the ideas coming from complexity science are now widely studied and used to help with a wide range of decisions and issues. And, accepting the complexity of the world we inhabit is really about admitting the wonderful unpredictability and creativity of the universe, while facing the reality of our potential vulnerability, and that of the institutions, organizations, and economic systems that frame our lives. In such a changing and uncertain world, people naturally seek comfort and safety and it has been easy for 'experts' to sell false 'certainty', optimal solutions and neat 'net present value' calculations about the future. And most people have enjoyed the seductive attractions of simple incantations and magic to the doubtful and more worrying truth. And science was seen as one of the ways that fear could be allayed as experiments and theories revealed the underlying laws of nature which governed the universe, and were definitely true for all time. Theories might start off initially in some crude and slightly incorrect way, but gradually over time, scientists of genius honed them to perfection and seemed to usher in an age of prediction and control.

But it is the scientific method of rational experimentation and reflection that revealed the limits of rational experimentation and reflection. Hard science was only possible if a new theory produced testable predictions that could be falsified, and also could be tested by different scientists independently. Such a process can indeed lead to genuine cumulative knowledge within a domain where repeatable experiments are possible. But where are repeatable experiments possible?—in closed systems whose contents can be named and counted, and reproduced elsewhere and by others. It is the classic 'in vitro' situation. However, the world we actually inhabit is not like this. Our world is made up of multiple interconnected evolving systems of entities that are open to flows of energy, matter and information. They are 'open systems' that are connected to their surroundings and therefore cannot be cut off from their context. The possibility of making repeatable experiments is therefore much reduced because we would need not only to copy the system but also its context, and maybe the context of that context. This means that our understanding is therefore based on less severe selection criteria, because we cannot guarantee that any two seemingly similar systems will have sufficiently comparable internal parts, contexts and histories to constitute a verification of a prediction. This is typical of all 'in vivo' situations. Living systems create a world of connected, coevolved, multi-level structures which although temporally, sufficiently self-consistent to 'operate' for a time, will inevitably evolve, adapt and change over longer periods.

Can a 'complex system' ever be completely clearly understood? In terms of being 'understood' as a set of interacting mechanisms that describe the actions and responses of its parts, then the answer is no. If it could be described completely as a mechanical system, then it would not be complex. But neither would such a system be able to adapt, evolve and change. Because complex systems have emerged through evolutionary, historical processes, they are such that although at any given time they may have an apparent structure, they also contain within them heterogeneous elements and micro-diversity that mean that at any time there is not just one system present, but instead a plurality of 'possibles'. What we encounter in the world are not systems with a single, simple clear set of mechanisms that an 'expert' could use as a basis for prediction. Instead, we find messy, multiple perspective, paradoxical systems, with the capacities required to evolve, adapt and change, since it is these that have the capability to 'get through history' and meet us in the present. Survivability trumps style in the universe!

In many of the real-world examples discussed in this volume successful emergence and persistence of structure and organization demonstrate complexity —requiring not only elements that obey the current rules, but also internal layers, elements and individuals who have different ideas and the freedom to try some of them out. Instead of our understanding of a complex system leading to a single knowledge and truth we find diverse, even contradictory, underlying beliefs and habits. Instead of a set of functional mechanisms giving rise to a 'machine', we find a messy set of interactions that an 'observer' may mistakenly interpret as a machine for doing whatever it is doing. It is a case of mistaken inferred intentionality! For example ecosystems do not set out to achieve any particular outcome such as maximum energy capture or entropy production, and 'markets' do not set out to come to equilibrium, and to maximize either producer profits or consumer utilities. Of course, artefacts and perhaps organizations designed by humans for a purpose may appear to operate mechanistically for a time, but the designers, the users and the world in general will actually have to change over time, or they will disappear. This means that even if an artefact is a machine, the 'artefact making process' will in fact be part of a complex evolving system. So we have to recognize that whatever particular pattern of interaction may exist between the participating elements of a system, this may not be stable, and over time new elements, new interactions and a new overall performance may emerge—and indeed that history is made by a succession of such instabilities and the non-average elements and events that trigger them.

Fortunately, today we can imagine and build models that help us look at the possible consequences of particular actions or policies—if our assumptions concerning the structure of the system hold. And we can attempt to explore the probable effects of possible events and surprises that we can imagine. Sometimes we can also use 'fluctuations and noise' to explore the stability of structures, and perhaps find new stable states that had not been imagined. However, there will always be new dimensions that we cannot imagine, with consequences that we cannot anticipate. But, nevertheless, developing models to better imagine, explore and compare the probable outcomes certainly seems more responsible than not doing so. But if such models are believed (e.g., climate change) then they can and do change the behavior that is included within them, and become part of the political process, subject to the manipulations and misrepresentations of different interested parties.

We face the paradox that if complexity science is used to explore possible futures, then providing the work is either ignored or secret, it will not affect the behaviors included within them. Presumably then the analysis and models will work best providing they are never talked about or used too much. However, most of us (and our sponsors) would feel that this is not really our aim.

Our aim is more that the complexity analysis should be useful and be believed. But if the analysis is considered credible and is taken seriously by people including the agents involved in the model, then the behaviors included within the analysis may change, and the analysis will no longer be valid. Although this seems like some kind of failure, the work may still have achieved its aim of changing people's behavior—possibly, for example, reducing the danger of climate change. In this perspective, the analysis and model-building will then become part of the larger system and of the political process and could be used iteratively to explore the changed predictions resulting from the responses of agents to the analysis that has been presented. All this does is to underline and accept the idea that we are all taking part in an on-going, imperfect, learning process. We will not find THE answer! Our reflections affect our behavior which in turn affects what will happen, and the changed situation is naturally taken into our continuing reflections. This is another example of multi-level coevolution. Here it is the inside, the interpretive frameworks of agents, coevolving with other agents and with their social, cultural and economic environment.

What all this emphasizes is that complexity, despite being more correct than the old mechanistic ideas that gave us so much through science and technology, does not offer us an alternative way of achieving the old aims of prediction and control. Instead complexity is really about 'growing up' and accepting that there are serious limits to our knowledge. It is about humility rather than hubris. We are still learning and forgetting things and this will never end. Many people thought that because communism 'failed' then 'free markets' must be the best and only way of doing things. But as we have seen markets free enough to borrow incredible sums and wager them on the continuance some existing trends, such as rising house prices, can fall over a cliff. Many people who 'take up' complexity thinking make the simplistic assumption that the 'self-organization' exhibited by a complex system must be 'good'. But as we have stressed complex systems are multi-dimensional, and have a diversity of agents with heterogeneous views on what is good or bad, and so it is absurd to assume that 'whatever happens must be good'. It is part of our on-going learning process to explore possible social and economic forms and attempt to evaluate their relative merits. And even when we think we have something that is not too bad, it may still show us later some hidden aspects that may force us to reconsider.

So, in a way the study of complexity does not so much solve our problems as point out their multiplicity and interconnectedness. Since this seems to be the truth, then we should accept the on-going task of trying to make sense of things, and guiding actions, if we can, in directions that agree with our values.

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Organizations of all kinds struggle to understand, adapt, respond and manipulate changing conditions in their internal and external environments. Approaches based on the causal, linear logic of mechanistic sciences and engineering continue to play an important role, given people's ability to create order. But such approaches are valid only within carefully circumscribed boundaries. They become counterproductive when the same organizations display the highly reflexive, context-dependent, dynamic nature of systems in which agents learn and adapt and new patterns emerge. The rapidly expanding discussion about complex systems offers important contributions to the integration of diverse perspectives and ultimately new insights into organizational effectiveness. There is increasing interest in complexity in mainstream business education, as well as in specialist business disciplines such as knowledge management. Real world systems can't be completely designed, controlled, understood or predicted, even by the so-called sciences of complexity, but they can be more effective when understood as complex systems. While many scientific disciplines explore complexity principally through abstract mathematical models and simulations, *Emergence: Complexity & Organization* explores the emerging understanding of human systems from both the 'hard' quantitative sciences and the 'soft' qualitative perspectives.

This 2010 Annual includes articles from Göktuğ Morçöl, Lynne Hamill, Mika Aaltonen, Glenda Eoyang, Lasse Gerrits, Jean Boulton, and many more, that explore a range of complexity-related topics from philosophical concerns through to the practical application of complexity ideas, concepts and frameworks in human organizations. Also included are a series of four reproductions of classic papers in the fields of complexity and systems, each with critical introductions that explore their modern relevance:

"The Science of 'Muddling' Through" by *Charles E. Lindblom*
(originally published in 1959)
"Why is Economics not an Evolutionary Science?" by *Thorstein Veblen*
(originally published in 1898)
"The Theory of Emergence" by *Reuben Ablowitz*
(originally published in 1939)
"Determinism and Life" by *Conrad Hal Waddington*
(originally published in 1972)

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