

What can we learn from a theory of complexity?

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Introduction

The aim of this article is to investigate the implications of a general theory of complexity for social institutions and organizations, such as business corporations. Complexity theory has implications for the way we conceive of the structure of an organization, as well as for the way in which complex organizations should be managed. However, a preliminary warning is necessary: The lessons to be learned from the study of complexity are somewhat oblique. Any hope that a study of complex systems will uncover the way of running an organization is in vain. While we will not come up with a quick fix, the lessons are most certainly important. The first half of the article will investigate what we can learn from a theory of complexity. Most of these insights are widely accepted, but it is useful to revisit them briefly. This general understanding of complex systems also provides the background to the second half of the article, in which I investigate what we cannot learn from complexity theory. The “negative” part of the article is at least as important as the “positive” part. There I will investigate the unavoidability of an ethical dimension to all decisions made in a complex environment.

Complexity in a nutshell

I will not provide a detailed description of complexity here, but only summarize the general characteristics of complex systems as I see them.¹

1. Complex systems consist of a large number of elements that in themselves can be simple.
2. The elements interact dynamically by exchanging energy or information. These interactions are rich. Even if specific elements only interact with a few others, the effects of these interactions are propagated throughout the system. The interactions are nonlinear.
3. There are many direct and indirect feedback loops.
4. Complex systems are open systems—they exchange energy or information with their environment—and operate at conditions far from equilibrium.
5. Complex systems have memory, not located at a specific place, but distributed throughout the system. Any complex system thus has a history, and the history is of cardinal importance to the behavior of the system.
6. The behavior of the system is determined by the nature of the interactions, not by what is contained within the components. Since the interactions are rich, dynamic, fed back, and, above all, nonlinear, the behavior of the system as a whole cannot be predicted from an inspection of its components. The notion of “emergence” is used to describe this aspect. The presence of emergent properties does not provide an argument against causality, only against deterministic forms of prediction.
7. Complex systems are adaptive. They can (re)organize their internal structure without the intervention of an external agent.

Certain systems may display some of these characteristics more prominently than others. These characteristics are not offered as a *definition* of complexity, but rather as a general, low-level, qualitative *description*. If we accept this description (which from the literature on complexity theory appears to be reasonable), we can investigate the implications it would have for social or organizational systems.

Complexity and organizations

The notion of complexity has been applied to organizations in a number of different ways, and with varying degrees of rigor. I would like to emphasize two things. In the first place, the principles discussed here are of a very general nature. The contingent

conditions at stake when investigating a specific case will be relevant, and may radically affect the importance of some of the implications. Despite this remark, I wish to stress, secondly, that this does not mean that the acknowledgment of the complexity of a situation allows us to be vague, nor does it imply a chaotic state of affairs. Complexity theory has important implications for the general framework we use to understand complex organizations, but within that (new) framework we must still be clear, as well as decisive.

1. Since the nature of a complex organization is determined by the interaction between its members, relationships are fundamental. This does not mean that everybody must be nice to each other; on the contrary. For example, for self-organization to take place, some form of competition is a requirement (Cilliers, 1998: 94-5). The point is merely that things happen during interaction, not in isolation.
2. Complex organizations are open systems. This means that a great deal of energy and information flows through them, and that a stable state is not desirable. More importantly, it means that the boundaries of the organization are not clearly defined. Statements of “mission” and “vision” are often attempts to define the borders, and may work to the detriment of the organization if taken too literally. A vital organization interacts with the environment and other organizations. This may (or may not) lead to big changes in the way the organization understands itself. In short, no organization can be understood independently of its context.
3. Along with the context, the history of an organization co-determines its nature. Two similar-looking organizations with different histories are not the same. Such histories do not consist of the recounting of a number of specific, significant events. The history of an organization is contained in all the individual little interactions that take place all the time, distributed throughout the system.
4. Unpredictable and novel characteristics may emerge from an organization. These may or may not be desirable, but they are not by definition an indication of malfunctioning. For example, a totally unexpected loss of interest in a well-established product may emerge. Management may not understand what caused it, but it should not be surprising that such things are possible. Novel features can, on the other hand, be extremely beneficial. They should not be suppressed because they were not anticipated.
5. Because of the nonlinearity of the interactions, small causes can have large effects. The reverse is, of course, also true. The point is that the magnitude of the outcome is not only determined by the size of the cause, but also by the context and by the history of the system.² This is another way of saying that we should be prepared for the unexpected. It also implies that we have to be very careful. Something we may think to be insignificant (a casual remark, a joke, a tone of voice) may change everything. Conversely, the grand five-year plan, the result of huge effort, may retrospectively turn out to be meaningless. This is not an argument against proper planning; we have to plan. The point is just that we cannot predict the outcome of a certain cause with absolute clarity.
6. We know that organizations can self-organize, but it appears that complex systems also organize themselves toward a *critical* state.³ This not only means that at any given point we can expect the system to respond to external events on all possible scales of magnitude, but also that the system will organize itself to be maximally sensitive to events that are critical to the system's survival. Think of language as a complex system. If there is a desperate need for new terms to describe important events, the system will organize itself to be critically sensitive to those terms specifically, and not necessarily to other novel terms. The “need” is determined by the context and the history of the system, not by a specific “decision” by some component of the system. Similarly, an organization will self-organize to be critically sensitive to specific issues in the environment that may affect its wellbeing. The implications of self-organized criticality for organizational systems seems to be a subject that demands further investigation.
7. Complex organizations cannot thrive when there is too much central control. This certainly does not imply that there should be *no* control, but rather that control should be distributed throughout the system. One should not go overboard with the notions of self-organization and distributed control. This can be an excuse not to accept the responsibility for decisions when firm decisions are demanded by the context. A good example here is the fact that managers are often keen to “distribute” the responsibility when there are unpopular decisions to be made—like retrenchments—but keen to centralize decisions when they are popular.
8. Complex organizations work best with shallow structures.⁴ This does not mean that they should have *no* structure. This point requires a little elaboration. Complexity and chaos—whether in the technical or the colloquial sense—have little to do with each other. A complex system is not chaotic, it has a rich structure. One would certainly not describe the brain or language, prime examples of complex systems, as “chaotic.”⁵ I certainly would not put my trust in a chaotic organization. A complex system does have structure, but not a strictly hierarchical structure; perhaps not even a shallow structure. Structure can be shallow, but still extremely hierarchical. Perhaps the best way to think of this would be to say that there should be structure on all scales, and much interaction between different structural components. This is another aspect of complex organizations that could be fleshed out with insights from self-organized criticality.