CHAPTER 1: WHY EMERGENCE?

DESCRIBING EMERGENCE

Emergence is the creation of order, the formation of new properties and structures in complex systems. When emergence happens, something new and unexpected arises, with aspects that can’t be predicted even from knowing everything about the parts of the system. Emergence is studied in every field – from physics to philosophy: Physicists study emergent properties of molecules and forces, biologists study emergent behaviors of animal groups, sociologists study emergent structures in society, entrepreneurship scholars study the emergence of organizations. Emergence is one of the most ubiquitous processes in the world, and yet one of the least understood.

Three examples will give shed light on some key issues of emergence. The first example is seemingly simple: the V-shape that is made by a flock of flying birds. The shape is emergent: it is not caused by any one bird’s behavior, nor is there a leader in a flock. Instead, each bird individually is following simple rules that maximize its own efficiency in the group: fly close together, but avoid contact; if you get too close then separate; and fly in the overall direction of the group. These rules, which guide the local actions of each individual bird, also lead to an emergent structure – what we see as a V in the sky – which increases the efficiency of all the birds in the group. The V is emergent because it is not caused by any one bird but by all the birds interacting together; the V is made up of all the birds but ‘transcends’ them as well.

As another example, consider a natural ecosystem like a forested area. Each of the parts of the ecosystem – all the different species of trees, plants, animals, insects and so on – are competing for their own survival and growth. Yet from a system-wide perspective all of these apparently independent organisms are interdependent – they each need the others in order to survive and thrive. Further, the dynamic interactions and relationships across the entire ecosystem generate a resilience, an increased ability of the system to support the organisms within it in the long term. This system-wide property of resilience is emergent, for it is not ‘in’ any one element or species, but arises through the interactions and relationships across all of them.

The same can be said for organizations, which are emergent systems. To the outside world an organization exists as a distinct social entity – it follows rules and laws, it ‘acts’ in certain ways, and contributes to the local community. But where ‘is’ the organization, in relation to the parts that make it up? The business is not ‘in’ the individual employees, for all of them could be replaced without necessarily destroying the company. Nor is the organization ‘in’ its managers or the founders, who often do not interact with customers. The organization is not ‘in’ the building (or website), nor is it ‘in’ the individual exchanges (transactions) that occur in-person or online. Nor is the company to be found ‘in’ its performance. Like the other two examples, organization is an emergent entity: it arises as a whole-system out of the combined interactions and relationships of elements, but does not exist ‘in’ any one of those elements. At the same time the emergence process generates new opportunities and more energy than could be done by adding up all the activities of all of its parts.
Emergence is present at every level of reality; for example, we encounter it in patterns of interaction that arise in our departments and workplaces, in the cultural norms that guide our behavior and expectations, and in the initiation of new projects and ventures. Emergence is also at the heart of complexity science – disciplines that use computation and non-linear methodologies to explore the creation of order in the natural and social world. In fact I will argue that emergence is at the core of what complexity science is really about.

Although more and more scholars are engaged in using complexity science and studying emergence, few people are aware of how many types of emergence have been being studied across the social sciences. To give some examples: Leading entrepreneurship researchers have been studying the emergence of new ventures, the creation of new markets, and the generation of regional clusters. Organizational scientists are exploring emergence in group dynamics, in the dynamics of innovation, in the development and implementation of strategy, in processes of change and transformation, and in the creation of new institutions and industries. Research in the psychological sciences has identified emergence processes in neurophysiology, cognition, and individual behavior. Sociological studies have highlighted emergence dynamics in collective behavior. Overall, the scholarship of emergence is dramatically expanding: the past 20 years has seen a 782% increase in research papers focusing on emergence within psychology, sociology, economics, education, and management.

The same can be said for book-length treatises on emergence. In the social sciences, major contributions and compilations have been written by Stephen Guastello (Guastello, 1995) in psychology, Alicia Juarrero (Juarrero, 1999) in philosophy, Harold Morowitz (Morowitz, 2002) in evolutionary studies, Keith Sawyer (Sawyer, 2005) in sociology, (Clayton & Davies, 2006) in physics and biology, Robert Reid (Reid, 2007) in biological evolution, (Bedau & Humphres, 2008) in philosophy and the natural sciences, and (Padgett & Powell, 2011) in organization theory.

General introductions to emergence and complexity science have exploded as well, as evidenced in successful books by Michael Waldrop (Waldrop, 1992), Roger Lewin (Lewin, 1992), Gell-Mann (Gell-Mann, 1994), Kevin Kelly (Kelly, 1994), Steven Johnson (Johnson, 2001), Bar-Yam (Bar-Yam, 1997), Strogatz (Strogatz, 2003), Neil Johnson (Johnson, 2009) and Melanie Mitchell (Mitchell, 2009). These of course take their place amongst their precursors, including Jantsch (Jantsch, 1980), Depew & Weber (Depew & Weber, 1985, 1994), Gleick (Gleick, 1987), Adams (Adams, 1988), Cilliers (Cilliers, 1998), and others.

Overall we have seen a dramatic increase in the pace and scope of writing on dynamic complex systems and the emergences they describe. However up to now each contribution has been separate: Few books on emergence build on previous work, and few emergence scholars refer to others in different fields. Likewise, almost all of the scholarly books on complexity science have focused on (only) one or a few disciplines. For example, Kauffman (Kauffman, 1993) focuses on NK Landscape models; Holland (Holland, 1995; Holland, 1998) focuses on Genetic Algorithms; Prigogine (Nicolis & Prigogine, 1989; Prigogine & Stengers, 1984) focuses on dissipative structures; Bar-Yam (Bar-Yam, 1997; Bar-Yam, 2004) on mathematical and computational approaches; Bak (Bak, 1996; Bak & Chen, 1991) on self-organized criticality, and
so on. Although we have come to accept these studies as definitive, they each introduce an aspect of the whole, but none have explored the entire multi-layered context of emergence.

The time is ripe for an integration of this work into a discipline of Emergence. Such a discipline would organize all of the writing and research on emergence and complexity science into a single framework, which could serve as the basis for synthesis and further insights across many levels of analysis.

This book makes an important step toward that goal, by drawing together the entire range of empirical literature on emergence into a single framework and a testable definition. In the first part of the book I take a broad perspective by drawing on emergence research from physics, chemistry, computational science, agent-based modeling, biology, ecology, evolutionary studies, philosophy, psychology, sociology, and organization science. Then in the second part of the book I focus on Generative Emergence, which explains the creation and re-creation of organizations, ventures, projects, initiatives, and social endeavors of all kinds. The central portion of the book introduces the Five-Phase process model of Generative Emergence, an approach developed over 30+ years of my own research in concert with many others.12

WHY EMERGENCE? PROBLEMS AND POTENTIALITIES

Generative Emergence aims to solve some longstanding problems in management and the social sciences, and unlocks new potential in the complexity sciences. In particular, by understanding the dynamics of emergence we can:

(a) Explain why emergence and re-emergence in social systems generates more benefits than can be gained through more common modes of growth and change;

(b) Solve some debates in entrepreneurship and organization science by distinguishing the process of emergence from its outcomes;

(c) Expand the value and applicability of complexity science in management and other social sciences by showing how each of its 15 disciplines provides unique insights into the emergence process;

(d) Increase the rigor of applications in management by providing a grounded explanation for the common notion of self-organization; and

(e) Synthesize a host of research across entrepreneurship, strategy, organizational behavior, innovation, and institutional theory, through a general model of emergence organizing.

I describe each of these benefits briefly.

(a) Emergence and Re-Emergence, versus Change and Transformation

Among the scholars who study organizational change and transformation, these two processes reflect the entire range of possible shifts that can occur within a company – from incremental change and adaptation to significant transformations in structures, systems and processes
(Bartunek & Moch, 1987; Gersick, 1991; Greenwood & Hinings, 1996; Staudenmayer, Tyre, & Perlow, 2002; Weick & Quinn, 1999). In the first case organizations change by learning from their experience and incrementally improving their situation (Huber & Glick, 1993; Levinthal, 1991; March, 1981; Quinn, 1989). Through transformation, organizations call into question one or more guiding assumptions and values, leading to a major shift in several aspects of the organization (Bacharach, Bamberger, & Sonnenstuhl, 1996; Bartunek, 1984; Romanelli & Tushman, 1994; Street & Gallupe, 2009).

On the surface one might think that emergence is simply a fancy way to describe transformation – but this is a mistake. Organizational transformation, like organizational change, focuses on a modification of existing elements, an alteration of design structures, internal processes or activity routines in the organization. Like all path-dependent processes, the outcome crucially depends on the history of the system as well as the trigger for change or transformation; the possible outcomes are conditioned by the existing state and by what initiates the process itself.

According to virtually all these theories, the trigger for organizational change or transformation is a crisis – a growing problem or a pending catastrophe – which is always expressed as a gap in performance: The company is not performing well enough in its domain, so change or transformation is necessary. Only a crisis would be strong enough to dislodge the inertia of current operations; transformation is a reaction to a changing environment that aims to bring the organization back into an effective mode.

Emergence, however, is almost totally different than transformation for several reasons. First, emergence is creation, not simply change. Emergence is the invention of something new, the origination of a distinct system and/or the structures within it. Like the V of a flock of birds, the emergent entity is not a change, nor even a transformation of the birds – instead it is a new creation, a ‘becoming’ that goes beyond the activities of the parts. No amount of change can produce an emergent entity.

Second, the trigger for organizational emergence is aspiration – the vision and enactment of a new opportunity that can be achieved. Whereas crisis leads to a reactive attempt to save the organization, aspiration is an entrepreneurial desire to create value, to make a new contribution to a community or within a market. For this reason emergence and re-emergence are initiated when nothing is wrong: they are not triggered by problems or urgent issues. Instead the origin of emergence is a potentiality, a spark of creativity, an open-ended possibility that can be enacted in a myriad of ways.

Third, this spark of creativity produces a whole different style of action than accrues through crisis-driven change. According to creativity scholars, problems and frustrations lead to “reactive creativity” which is characterized by negativity and even a sense of desperation (Heinzen, 1994, 1999; Unsworth, 2001). In contrast, “proactive creativity” is characterized by “intrinsic motivation, positive affect, and focused self-discipline” (Heinzen, 1994: 140). Research has shown that this prospective, problem-finding outlook is much more likely to spur useful ideas in organizations (Axtell et al., 2000), and to improve innovation more generally (Unsworth, 2001). Thus, the potentialities for emergence are greater than for transformation.
Finally, these greater potentialities are easily seen through empirical studies of emergence. Research shows that emergent structures expand the capacity of the system by an unprecedented amount, vastly increasing the capability of the system to accomplish its goals (Prigogine & Stengers, 1984; Swenson, 1988, 1989). Intuitively this is evident in the three examples of emergence, each of which improves the efficiency, adaptability, and performance of their systems in ways that would be impossible through common modes of change. Thus, in all these ways, emergence and re-emergence are distinct from transformation, and they provide many more avenues for creative innovation and dramatic increases in capacity. Much more about these findings will be presented in the following chapters.

(b) Emergence as a Process with a Range of Outcomes

In organization science, emergence has mainly been used to describe a condition or situation, as for example “The emergence of ethical issues” (Sonenshein, 2009), or to describe the outcome of a process, as for example “The emergence of a proto-institution” (Lawrence, Hardy, & Phillips, 2002), or “The emergence of new practice areas” (Anand, Gardner, & Morris, 2007). At the same time, a variety of scholars explore the dynamics or the conditions which give rise to emergence – as for example in (Chiles, Meyer, & Hench, 2004), (Plowman et al., 2007a), and (MacIntosh & MacLean, 1999). Further, some research proposes a series of sequential phases that lead to emergence, as exemplified by (Smith & Gemmill, 1991),(Leifer, 1989), (Purdy & Gray, 2009), and my own work (Lichtenstein, 2000a, c; Lichtenstein & Plowman, 2009). These differences reflect an uneasy question: Is emergence more of a process, or an outcome, or some of both?

This question has never been fully answered, which has led to some confusion across a variety of fields. The confusion is heightened by the assumptions underlying almost all computational approaches to complexity science – e.g. (Fleming & Sorenson, 2001; Ganco & Agarwal, 2009; Gavetti & Levinthal, 2000; Gavetti, Levinthal, & Rivkin, 2005; Levinthal & Warglien, 1999) – which show the emergence of structure and patterns, but don’t reveal the underlying processes which might spark such emergence. (This point will be expanded in the next section). The confusion between process vs. outcomes is also aggravated by the popularity of “self-organization” – a term which is both a process and an outcome, and is used in both ways simultaneously, e.g. (Plowman et al., 2007b; Smith & Gemmill, 1991; Tapsell & Woods, 2010). (Again, this will be drawn out in a section to follow).

As my framing suggests, emergence is most usefully understood as a process which generates an outcome, or more validly a range of possible outcomes. Although this response seems simple enough, a good portion of the book is dedicated to exploring the dynamics of the process and how these dynamics can be expressed in distinct but overlapping phases (see Chapters 6, 7, 8, and 15), and in highlighting the range of outcomes from this process – including no emergence, and the continuum of 1st degree, 2nd degree, and 3rd degree emergence (see especially Chapters 5 and 9, as well as Chapter 13). However the lack of these distinctions up to now has led to some persistent debates in organization science, which more clarity might help to resolve. Two of these debates I will mention briefly.
The first, based primarily in entrepreneurship, is the question of whether business opportunities are primarily ‘objective,’ existing independent of an entrepreneur who may discover it, or whether opportunities are ‘subjective,’ coming-into-being only through their enactment and organizing. This debate is quite current, as shown by the January 2013 Dialogue section in the Academy of Management Review (Vol. 38, #1), in which four sets of authors present alternative views as to the existence and realization of opportunity. From an emergence perspective – viewing opportunities as emergents which can be enacted – the debate reflects a conflation of emergence as a process vs. an outcome. According to the ‘discovery’ approach opportunities are an outcome, the result of conditions and constraints in technology, markets, and entrepreneurs. According to the ‘subjective’ approach, opportunities are an emergent process; a viable opportunity is one that becomes increasingly visible and tangible through entrepreneurial organizing processes. By distinguishing these two ‘faces’ of emergence, the debate resolves into issues of methodology and theoretical preference.

The second debate, less intense but no less interesting, refers to the longstanding query into the resources, qualities or conditions that lead to organizational emergence. This question has been asked by entrepreneurship scholars in terms of the activities which give rise to new ventures (Brush, Manolova, & Edelman, 2008; Delmar & Shane, 2003, 2004), the resource endowments which lead to successful start-up (Brush & Greene, 1996; Cooper, Gimeno-Gascon, & Woo, 1994; Reuf, Aldrich, & Carter, 2003), and the environmental conditions that mediate business creation processes (Aldrich & Fiol, 1994; Almandoz, 2012; Schoonhoven & Romanelli, 2001). However, these questions are one sided, missing the fundamental contribution provided by process models of emergence. For example, our study (Lichtenstein, Carter, Dooley, & Gartner, 2007) showed that new venture start-up depended solely on dynamics of emergence – on an underlying process model – not on what activities were enacted nor what order they were completed. By further integrating the dynamics of emergence into studies of entrepreneurship, by incorporating emergence process models as a complement to traditional outcome studies, a great many insights about organizational creation may be gained.

Further applications can be made but these two debates exemplify the potential that emergence has in bringing clarity to a range of organizational issues.

(c) Expanding the Potential for Complexity Science

To virtually all scholars who are familiar with complexity science, there is a realistic perception that complexity research means studies which use computer simulations, i.e. that the only way to explore how order is created in complex systems is through computation and agent-based modeling. This bias – and it is a strong one – comes clear in most scholarly reviews of complexity in organization science, which treat the study of complex systems and emergence as a computational issue (e.g. (Axelrod & Cohen, 2000; Cowan, Pines, & Meltzer, 1994; Sorenson, 2002) (Anderson, 1999; Prietula, 2011). The same can be said of popular summarizes as well (Downey, 2009; Johnson, 2009; Johnson, 2001; Mitchell, 2009).

To be fair, computational applications of complexity science have gained great visibility in organization science, through scores of top-tier publications which utilize computer simulations...
to explain various patterns in the social world (Boiset & Child, 1999; Boisot & McKelvey, 2010; Ganco & Agarwal, 2009; Gavetti & Levinthal, 2000; Levinthal, 1997; Levinthal & Myatt, 1994; Levinthal & Warglien, 1999; McKelvey, 1999a, b; Rivkin & Siggelkow, 2003, 2007; Siggelkow & Rivkin, 2005; Sommer, Loch, & Dong, 2009). Of course this does not represent the entire scope of complexity research, but it certainly leaves out a good deal of research insights which are not generated through algorithmic or computational methods.

Further, computational methods have limitations that are rarely expressed but which have recently been noted. One of these limitations refers mainly to NK Landscape studies, i.e. computational simulations which utilize the methods developed by Kauffman (1993) and extended by McKelvey, Levinthal and others (e.g. (Ganco & Agarwal, 2009; Levinthal, 1997; Levinthal & Myatt, 1994; Levinthal & Warglien, 1999; McKelvey, 1999a, b; Sommer et al., 2009). According to an in-depth analysis by McKelvey and his collaborators (McKelvey, Li, Xu, & Vidgen, 2010), “NK-model results appear to be artifacts preordained by the code rather than by theory-based experiments. … Consequently, ‘moderate complexity’ – i.e. when K is neither zero nor large – always wins.” (p.1, 6). It turns out that this result is found in some form in every NK-model; some reflection will confirm that in each case the theoretical framework is ‘designed’ around this outcome. While not invalidating the importance of this stream of research, it does give pause to the direct applicability of these results for management.13

Another more broadly based problem with computational versions of complexity science is their reliance on effects that are programmed into the agents, rather than being truly emergent results of their interactions. Sawyer makes the strongest case for this (Sawyer 2004, pg. 164-165):

First, the macrostructures or macroproperties do not themselves emerge from the simulation but are imposed by the designer. Yet in actual societies, macrophenomena are themselves emergent from microprocesses. …

A second problem in applying these multilevel artificial societies to sociological theory is that agents do not have any perception of the emergent collective entity (Castelfranchi 1998; Conte et al. 1998; Servat et al 1998). In the CORMAS simulation, agents do not know that they are being taxed, nor that a quota has been imposed. In the EOS simulation of group formation… no agent has awareness of its own group as an entity, and agents that are not in a group have no way of recognizing that the group exists or who its members are.

In time these problems may be solved with greater programmatic advances; the field continues its long trajectory of growth. But at a minimum these problems suggest that more attention should be paid to complementary methods of complexity science, of which there are many.

A few researchers have presented a more inclusive view of complexity science. In particular, McKelvey and his colleagues (Andriani & McKelvey, 2009; McKelvey, 2004c) have noted a distinction between the American School of complexity which emphasizes computational studies, and the European School which is grounded more in natural science explorations of order creation. Likewise, Goldstein (Goldstein, 1999, 2000) mentions nearly a dozen disciplines of complexity science in his introductions to its history and the foundations of emergence. Maguire and his colleagues (Maguire, McKelvey, Mirabeau, & Oztas, 2006) identified 25
disciplinary origins of complexity science, and framed a very wide spectrum of complexity contributions in four broad categories.

Admittedly there are challenges in many of these approaches, especially their reliance on metaphors to the underlying science which can lead to a lack of rigor in applications. Some of this may be solved through a review of the original science combined with an analysis that would generate an exacting analogy which would reliably link the underlying scientific principles to actual human behavior. This rigor is one of my core goals in this book, which is based on numerous studies that have engaged such a transformative approach (e.g. (Chiles et al., 2004; Plowman et al., 2007a). By increasing the rigor of non-computational approaches that are based in rich, longitudinal data, we are likely to gain a good deal of insight into how order actually emerges in complex human systems. These insights may help rejuvenate complexity science, bringing more depth and value to organization science.

(d) Problems with ‘Self-Organization’

Perhaps the most popular frame for emergence is in the term ‘self-organization’. Many of the original applications of complexity science in management were based on the idea of self-organization; for example in the early 1980s two edited books (Schieve & Allen, 1982; Ulrich & Probst, 1984) applied self-organization to understanding population dynamics (Zurek & Schieve, 1982), urban systems (Allen, 1982) and economics (Davidson, 1982). Smith’s work on self-organization (Gemmill & Smith, 1985; Smith, 1986; Smith & Comer, 1994; Smith & Gemmill, 1991) extended these ideas into organization behavior and management. In the past 15 years a host of management scholars have invoked the term self-organization in papers on

- leadership (Guastello, 1998; Plowman et al., 2007b; Zaror & Guastello, 2000) (Lichtenstein, 2000b),
- innovation and learning (De Vany, 1996; Lichtenstein, 2000b; Saviotti & Mani, 1998),
- market economics (Foster, 2000; Lesourne, 1993; Lesourne & Orlean, 1998) (Krugman, 1996),
- entrepreneurship (Biggiero, 2001; Buenstorf, 2000; Zuijderhoudt, 1990) (Lichtenstein, 2000a), (Lichtenstein & Jones, 2004),
- general management (Adams, 1988; Contractor et al., 2000; Gunz, Lichtenstein, & Long, 2001; McKelvey, 1999b; Salthe, 1989; Zohar & Borkman, 1997) (Ferdig & Ludema, 2005),

and more. Such applications remain common even now, e.g. (Butler & Allen, 2008; Saynisch, 2010; Stevenson, 2012; Tapsell & Woods, 2010; Wallner & Menrad, 2012).

Lack of Rigor in Applications of Self-Organization and Complexity

Two key problems plague self-organization. The first is a lack of specificity: People use the term in ways that are not rigorously connected to the underlying science. This problem is all too common with management applications of complexity science more generally, and has been
growing since the introduction of complex systems ideas in the 1990s. A useful view is given by Maguire & McKelvey (Maguire & McKelvey, 1999) in their introduction to a Special Issue on Complexity Applications in Management for the journal Emergence (now E:CO). There they summarize the problems with many management consulting books that ostensibly are using complexity and self-organization to understand organizations. Reflecting on the unclear links between the original science and the new applications, Maguire and McKelvey summarize the three dozen book reviews by noting authors’ “loose,” “less than rigorous,” “oversimplified,” and even sometimes “incorrect” use of concepts. And while metaphors are applauded, a number of reviewers feel that authors’ over-reliance on metaphors contributes to these “superficial” treatments. The absence of at least some mathematics in many books is conspicuous and undesirable for a number of reviewers, as is also the insufficient harnessing of simulations and computer models. In other words, the full toolkit of complexity has not been put on display for practitioners. Finally, although empirical examples are much appreciated, a number of reviewers feel that these are mere retellings of old tales using complexity terminology tacked on retrospectively, gratuitously and, in many cases, quite awkwardly. (pg. 23)

Fortunately, not all applications are loose; indeed, most of the complexity papers in organization science journals are tightly connected to their disciplinary foundations, i.e. they are based on rigorous and often testable analogies to one of the underlying sciences of complexity.

Moreover, some practitioner applications are also very strong. For example, the MIT Sloan Management Review 1999 Special Issue, “In Search of Strategy,” included two exemplars of rigorous complexity applications. (Pascale, 1999) reviews “four bedrock principles” from the science of complexity, creatively drawing on the work of Prigogine, Holland, and Kauffman. He then uses those to identify four assumptions that underlie a more adaptive approach to strategy. Similarly, (Beinhocker, 1999) develops a careful analogy from adapting agents in an NK Landscape theory to adapting organizations in a competitive landscape. Like many scholars who have made this link – but unlike most of his consulting colleagues who lack the necessary rigor – Beinhocker reviews the underlying framework of NK Landscape simulations, and then makes three strategic directives that are actionable applications of known experimental results.

These examples show that rigorous metaphors and analogies are valuable ways to apply complexity science – a claim that leading organizational researchers have made (Garud & Kotha, 1994; Tsoukas, 1991; Tsoukas, 1993). Still, underlying that distinction is a more fundamental issue, namely the question of agency in self-organization.

*Is Self-Organization as Simple as it Seems?*

The second problem of self-organization is due to the simplified notion of ‘agents’ that it draws upon, especially in the most common applications of self-organization, which are drawn from the computational sciences – complex adaptive systems theory(Holland, 1995; Holland, 1998), genetic algorithm models (Axelrod, 1997; Axelrod & Cohen, 2000), and agent-based models
In these approaches, agents are relatively simple learning entities that operate according to one or a few “simple rules,” and which only interact with local (proximate) agents. These studies then find “bottom-up” emergence, i.e. the creation of order occurs through the local interactions between agents, with no external influence or top-down control. As Clippinger explains (Clippinger, 1999): 6),

No one unit has any plan or even goal concerning how the overall system should act, and yet the system evolves into a complex structure adapted to its circumstances. ...Because complex systems adapt from the bottom up, there is no way of planning for change.

Although this is an intriguing description, does it reflect real and emergent behavior in social systems? Do emergent systems always act ‘of their own accord’?

Jeff Goldstein is especially clear about the problems with this perception that self-organizing can occur spontaneously. He notes that this interpretation of self-organization leads to a belief that

...novel structures would somehow emerge in organizations if only the ‘command and control’ hierarchy would be dismantled in favor of individual action. This misinterpretation led to a spate of management books pushing for ‘self-organizing’ as a form of laissez-faire leadership, [i.e.] that somehow relaxing managerial control would inevitably lead to ‘self-organization’ to solve the organization’s problems. (Goldstein, Hazy, & Lichtenstein, 2010): 80)

At least two issues are at play here. First from a leadership perspective, (Uhl-Bien & Marion, 2008; Uhl-Bien, Marion, & McKelvey, 2007) have shown that even if some organizing is motivated by ‘purely’ bottom-up actions, this is always balanced in formal organizations by bureaucratic as well as adaptive leadership. Together these provide the necessary strategies, resources, and decision-making context for so-called self-organizing activities. These additional layers of complexity reflect the differences between computational agents, which can be programmed to follow a single rule and which interact only with closely proximate agents. However, real managers would be very hard pressed to instill such constraints on their subordinates!

Furthermore, it appears that so-called self-organization is far from spontaneous and lacking in control structures. Instead, in all of the formal experiments which reveal “self-organization,” the outcomes are possible only because of constraints, containers, boundaries, and external structures – this issue will be explored much more deeply in Chapter 17. Goldstein continues,

A careful reading of the experiments and instances of self-organization reveals they are replete with a legion of non-spontaneous constraints that far out-number and far exceed in significance any appearances of spontaneous processes. (Goldstein, 2011), pg. 98, his emphasis).

Open systems – like organizations – do have the capacity for self-organization, but only when they are constrained in specific ways and when there are the requisite flows of
energy, resources, and information through the system and across its boundaries.  
(Goldstein et al., 2010: 80)

In sum, applying self-organization requires very careful attention to the underlying science, and to the agency of the actors in the system. These issues will be taken up in future chapters.

(e) Integrate Research Through a General Model of Emergence

As I’ve already mentioned, and will become even more clear as we continue, the range of research on emergence is enormous – far greater than their nascence in the social sciences would suggest. At the same time, by all appearances the research seems disjointed and not coherent, with topic areas that seem to be all over the map, and processes or outcomes that don’t seem much aligned across studies. Some examples will help make the point – compare especially the title and topic areas:

<table>
<thead>
<tr>
<th>Citation</th>
<th>Emergence of: (from title)</th>
<th>Topic area or Field</th>
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<tr>
<td>(Nowak, Tesser, Vallacher, &amp; Borkowski, 2000)</td>
<td>…Collective properties</td>
<td>Psychology; identity theory</td>
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<tr>
<td>(Marinova, Moon, &amp; Kamdar, 2013 - in press)</td>
<td>…Leadership emergence</td>
<td>Leadership</td>
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<td>(Zaror &amp; Guastello, 2000)</td>
<td>…Leadership emergence</td>
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<td>(Arrow &amp; Burns, 2004)</td>
<td>…Group norms</td>
<td>Groups; org behavior</td>
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<td>(Sawyer, 2001)</td>
<td>…Downward causation</td>
<td>Groups; org behavior</td>
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<td>(Lichtenstein, Dooley, &amp; Lumpkin, 2006)</td>
<td>…Emergence events</td>
<td>Entrepreneurship</td>
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<td>Organization theory, org design</td>
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<td>(Padgett &amp; Powell, 2011)</td>
<td>…Markets and organization</td>
<td>Organization theory, networks</td>
</tr>
<tr>
<td>(Tan, 2007)</td>
<td>…Phase transitions</td>
<td>Entrepreneurship; org theory</td>
</tr>
</tbody>
</table>
One would think there are few connections between the emergence of group norms, the ‘self-organization’ of entrepreneurial networks, the self-renewal of large corporations, the emergence of ethical issues, the emergence of new markets, and the emergence of institutional fields.

It turns out, however, that a general model of emergence can reveal many links and similarities across all these studies. These connections are relatively easy to make within the Five-Phase process model of emergence and the associated continuum of emergent outcomes, all of which will be proposed throughout this text. In other words, emergence as a discipline provides frameworks which cut across ‘levels of analysis’ and even across supposedly separate fields of organization science, psychology, sociology, and so on. That’s because rather than focus solely on content, emergence provides a model of process and outcomes. This model has already been shown to integrate studies within organization science (Lichtenstein & Plowman, 2009), and to organize a myriad of studies in entrepreneurship as well (Lichtenstein, 2011a; Lichtenstein, 2011b).

Moreover, embedded in the emergence model is a general framework for organizing developed by (Levie & Lichtenstein, 2010) and drawn out in Chapter 8. It is complementary and almost parallel to the approach taken by (Padgett & Powell, 2011), and allows links to a host of other research in the areas of ecological resilience (Baldwin, Murray, Winder, & Ridgway, 2004; Folke et al., 2004; Liu et al., 2007), sustainability (Buenstorf, 2000), bioeconomics (Foster, 2011; McKelvey, 2004b), and perspectives on organizational evolution (Foster & Metcalfe, 2012; Rosser, 1992).

In sum, a disciplinary approach to emergence leads to a number of important insights. First, emergence is distinct from organizational transformation, being initiated by aspiration and opportunity rather than by crisis, and which generates more capacity in the system. Second, this separation of the process of emergence from its outcomes solves some longstanding debates in entrepreneurship and organization science. Third, extending our understanding of emergence through complexity science reveals a much broader set of methods and approaches than are usually acknowledged in complexity-based applications. Fourth, with these shifts comes a much more rigorous explanation of self-organization, one which is true to the underlying science and integrates with a broader range of empirical findings. Fifth, this integration is part of a general theory of emergence that incorporates a Five-Phase process model and a range of emergent outcomes; the general model allows for a synthesis of much previous work across multiple fields.
To gain an initial appreciation of these benefits, and to provide an overview of the entire argument, I now turn to a summary of the chapters in the book.

**SUMMARY OF THE BOOK**

**PART I: FOUNDATIONS FOR A DISCIPLINE OF EMERGENCE**

The first three chapters provide an overview of emergence, offer a general definition of emergent outcomes, and offer one framework for a proposed discipline of emergence.

**Chapter 2: Defining Emergence and Generative Emergence**

I begin with a broad definition of emergence which draws on the best work I’ve found in philosophy and philosophy of science, evolutionary studies, sociology, and organization science. The result is a definition that summarizes decades of discourse into just five qualities of emergence. Specifically, these qualities allow one to assess whether a particular phenomenon is emergent (i.e. strongly emergent – (Bar-Yam, 2004; Bechtel & Richardson, 1992; Corning, 2002; Ryan, 2007)) namely that the emergent has properties or structures which are separate and essentially autonomous from the components which make it up. Thus, an entity or phenomenon is emergent (in the strong sense) if it expresses these qualities:

1. **Qualitative novelty**, meaning that its properties transcend its components, producing outcomes that are unpredictable and surprising even with a full understanding of the components. The V-shape of flocking birds expresses this well.

2. **Non-reducibility**, meaning that the emergent properties cannot be ‘reduced’ or explained solely by the system’s components, nor to their interactions alone. An example from biology is a cell – a living entity which cannot be explained by examining all of its separate components on their own.

3. **Mutual causality**, such that the components influence the system as a whole (upward causation), and the emergent properties have causal impact on the components (downward causation). A social example is a small organization, which is impacted by the actions of each of its employees, but which has system-wide qualities that influence and affect the behavior of all of its members.

4. **Structioning**, which refers to a kind of co-creative interchange between the agents’ agency – the drive and motivation within the system, and the constraints of the system – the boundaries and limitations of the container itself. An example is laser light, which is formed through an interchange between the electrical energy being forced into the system, and the mirrored walls of the container which constrain that energy, allowing it to build to a threshold wherein a new high-energy form of light is produced.

5. **Capacity is increased**, whereby the outcome confers greater efficiency, efficacy, and power to the components of the system and to the system as a whole. A good example is the eukaryotic cell, which produces up to 2000% more energy than its prokaryotic forerunner.

When all five qualities are present in an emergent, the outcome is defined as strong emergence.
With this grounding we are prepared to explore the entire range of emergents – the eight Prototypes.

**Chapter 3. Prototypes of Emergence**

Making a claim for a discipline of emergence assumes that we can make a list of all the different types of emergence that have been studied. Although it is quite hard to find a complete list, Chapter 3 begins by citing over 20 types of emergence drawn from physics, chemistry, computer science, bio-chemistry, biology, entomology, ecology, evolution, anthropology, sociology, linguistics, group dynamics, entrepreneurship, institutional theory, and economic geography.

How can these types be organized in a framework that is comprehensive yet parsimonious. My response is the identification of eight Prototypes of Emergence: Basic forms or archetypes of order-creation in the natural and social world. These Prototypes amount to a proposal; a framework that incorporates the entire range of emergents in the physical, computational, biological and social world. As a very brief summary the Prototypes are:

I. **Relational Properties**, such as temperature, pressure and viscosity. These are system-wide properties that ‘emerge’ out of the interactions of massive numbers of molecules in closed containers.

II. **Exo-Organization.** When high energy is directed (pushed) into a contained system, the result can be creation of new degrees of order. Examples are laser light, a highly coherent form of light wave, and dissipative structures like tornados, i.e. self-organized structures that emerge in highly dynamic systems.

III. **Computational Order.** Organized patterns and stable structures across computational agents. These structures are not programmed into the system but arise solely due to ‘simple rules’ for action and interaction that are programmed into each agent.

IV. **Autocatalysis.** Self-generating networks of interaction within chemical or biological systems. Once initiated, the reactions across the network produce the catalysts which spark the set of reactions, producing a self-reinforcing emergent entity.

V. **Symbiogenesis.** In biology, the creation of a eukaryotic cell is due to the ‘enveloping’ of a tiny organism (a mitochondria) within it; the emergent is more than 1000 times more effective at photosynthesis and other cellular functions.

VI. **Collaborative Emergence.** Dynamic interaction systems arise when many agents (organisms) guided by simple rules have high levels of interaction; examples include termite hills, traffic patterns, and the V-form in bird flocks. Another form of this is Stable Social Emergents (Sawyer, 2004), which include slang words, global brands, and collective memory, as well as the emergence of material and institutional systems that are based on shared cognitive frames.

VII. **Generative Emergence.** Social entities like organizations arise and remain stable, through creative agency and shared organizing schema. The value that is produced by the entity is exchanged for value (usually in the form of money), which is used to continuously generate the social entity. Examples also include projects, initiatives, and businesses.
VIII. Collective Action is a more macro form of Generative Emergence, being a collaborative process of organizing that can lead to social movements and institutional entrepreneurship.

In sum, the Prototypes provide a framework that allows us to view a much broader range of emergence than has been presented in most other complexity-science texts – a framework for an emergence discipline. At the center of this discipline is Generative Emergence, a form that has not yet been identified as a type of emergence. In my view Generative Emergence reflects a sustainable, continuously-generated process of value creation and exchange in social ecologies. By understanding the nature of Generative Emergence, we gain insight into the creation and sustaining of all kinds of social entities. Gaining such an understanding requires a shared knowledge about complex systems and how to study them – the topics of the next two chapters.

**PART II: STUDYING EMERGENCE THROUGH COMPLEXITY SCIENCE**

As mentioned earlier, this book is meant to be a contribution to Complexity Science as much as a clarion call for emergence. This contribution is solidified in Part II, which presents the entire range of complexity sciences that have been applied to organizations and social entities (Chapter 4), and a framework for understanding the quality of these applications, based on a summary of research in organization science (Chapter 5).

**Chapter 4. Methods for Studying Emergence – 15 Fields of Complexity Science**

The origins of Complexity Science, which follow the same multi-disciplinary approach as General Systems Theory, are 50+ years of research into non-linearity and dynamics in the fields of mathematics, physics, biology, information science, system dynamics, and more. Following numerous researchers who have argued for an inclusive definition of complexity (including (Goldstein, 1999),(Maguire et al., 2006),(Bar-Yam, 1997) and others), I argue that the entire scope of Complexity Science includes 15 fields. Each of these fields has its own theoretical frame, analytic methodology, and a set of applications in organization science and other social science disciplines; all of them offer a unique and non-linear perspective for understanding complex dynamical systems.

Some of these fields are more well-known than others; for example, NK Landscape models are familiar from the work of Kauffman (Kauffman, 1993), Levinthal (Levinthal & Warglien, 1999) and McKelvey(Mckelvey, 1999a); in contrast, few researchers have heard of or used autopoiesis (Maturana & Varela, 1980) or its related theory of autogenesis (Csanyi & Kampis, 1985; Drazin & Sandelands, 1992), although (Padgett & Powell, 2011) base their examination on these fields. The current list includes all of these distinct fields.

The 15 fields are:
Complexity Science | Originating Discipline
---|---
1. Determinist Chaos Theory | Mathematics; Atmospheric Science
2. Catastrophe Theory | Mathematics
3. Fractals | Mathematics
4. Cybernetics; Positive Feedback | Information Theory, Systems Theory
5. Power Laws; Self-Organized Criticality | Mathematics
6. System Dynamics | Information Theory; Computer Science
7. Complex Adaptive Systems | Computer Science
8. Cellular Automata | Computational Science
9. Genetic Algorithms | Computational Science
10. NK Landscapes | Computational Science
11. Agent-Based Modeling | Computational Science
12. Autogenesis, Autopoiesis | Biology; Systems Theory
13. Dissipative Structures Theory | Thermodynamics
14. Autocatalysis; Resilience | Biology; Ecology
15. Ascendancy; Evolutionary Complexity | Ecology; Evolutionary Theory

In the full chapter I present the theoretical or scientific origins of each discipline, give examples of how it has been used in Organization Science, and suggest how the discipline has been used to contribute to our understanding of emergence. As a whole these descriptions offer a comprehensive tool box for social scientists interested in studying emergence. The question that remains is: How to use these disciplines to explore emergence phenomena.

**Chapter 5. Types of Emergence Studies**

Social scientists, including researchers in organization science, have utilized these disciplines in surprisingly different ways, some more successful than others. A close look at all of these analyses reveals that emergence studies tend to cluster around one of four types or styles, each of which correspond to the quality of emergence they study. These types are *Complexity Metaphors*, *Complexity Descriptions*, *Complexity Models*, and *Generative Complexity*.

*Complexity Metaphors* use figurative language to draw attention to certain patterns in social and organizational systems. *Complexity Descriptions* go further by measuring or discovering an emergent, usually through post-hoc quantitative analysis. *Complexity Models* are formal or computational systems that enact emergence through computer simulations or agent-based programs. *Generative Complexity* refers to dynamic systems with emergents that actually generate greater capacity for the system as a whole.
Having outlined the 15 disciplines of complexity science, and reviewed the ways they are utilized – through one of four types of complexity – I move into the main argument of the book. Here I suggest that Generative Emergence, the kind of emergence most relevant to social scientists as well as to entrepreneurs, executives, and policy-makers, is best explored through the complexity discipline of Dissipative Structures Theory, and through the Generative Complexity type.

**PART III: THE THEORY BEHIND GENERATIVE EMERGENCE**

**Chapter 6. Dissipative Structures**

Of all 15 fields, dissipative structures the ideal for studying Generative Emergence because the ‘order-creation dynamics’ at its heart are highly applicable to organizations, ecosystems, and all social entities. Perhaps for this reason they have been used by so many researchers to explain transformation, innovation, and action in organizations, across organizations, as well as in psychology, economics, education, history, etc. In formal terms, the order-creation dynamics of this field capture the tangible behavioral qualities of Generative Emergence.

The most well known experiment in this discipline, the Bérnard Experiment, was explored deeply by Prigogine and his collaborators (Nicolis, 1989; Nicolis & Prigogine, 1989; Prigogine, 1955; Prigogine & Glansdorff, 1971; Prigogine & Stengers, 1984). In the Bérnard Experiment, a viscous fluid is heated from a source at the bottom of a round low container; normal conduction currents dissipate the heat, which is drawn out of the container through a sink at its top. Increases in heat energy can be assimilated, up to a point; but if the amount of heat energy is increased beyond a critical threshold, the fluid will experience a change of state – what Prigogine described as the onset of “self-organization” (Prigogine & Stengers, 1984). At this point the molecules across the entire container will organize themselves into stable structures which from above look like hexagons. These hexagonal structures dissipate far more heat energy than conduction currents can (Swenson, 1989, 1992; Swenson, 1997a).

The second experimental paradigm is a ‘chemical clock’ known formally as the B-Z reaction. Here, with the right reactants, a far-from-equilibrium chemical system can generate its own autocatalytic reactions. At that point the system exhibits system-wide shifts – oscillations like a clock – whereby the entire system changes from one color to a different one, and back again.

An analysis of both experiments reveals numerous parallels in their processes:

1. Once **initiated**, the system can move into a far-from-equilibrium state
2. Nearing a threshold, **fluctuations** (turbulence) arises throughout the system
3. At the threshold, the system exhibits non-linearity as well as bursts of **amplification**.
4. The emergent order that happens is a **re-combination** of existing elements in the system.
5. Emergent order remains **stable**, even when perturbed.
In terms of outcomes, the two experiments reveal:

- Emergent order increases the capacity of the system to a large degree.
- Following the basic tenets of multi-level systems, the emergent order ‘transcends but includes’ its components.\(^\text{19}\)

It turns out that these processes and outcomes are easily applied to organizations.

**Chapter 7. Applications to Organizations**

Although many researchers developed a direct parallel between thermodynamics and economics,\(^\text{20}\) I take a more moderate approach, to develop a rigorous metaphor between dissipative structures and order creation in organizations. It turns out that this rigorous ‘mapping’ approach reveals five sequential ‘phases’ of generative emergence. These phases are described briefly in the chapter, and at length in the chapters of Part IV.

**Chapter 8. Introducing Dynamic States**

As valuable as this transformative metaphor is, we are faced with a big problem, namely that the Experimental Conditions which lead to dissipative structures are vastly different from the conditions that social entities face in their efforts toward new order emergence. Those differences are easy to see in parallel form:

<table>
<thead>
<tr>
<th><strong>Experimental Conditions of Dissipative Structures:</strong></th>
<th><strong>Conditions for Generative Emergence</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A strong container. In the Bernard experiment it's a clear cylinder with source and sink attached.</td>
<td>Social emergence rarely starts within a formal boundary. Instead, the ‘container’ for Generative Emergence is shared vision and focused action; boundaries co-evolve.</td>
</tr>
<tr>
<td>Agents are homogeneous: Molecules are all the same, thus laws of statistical mechanics abide.</td>
<td>Social agents – people – are highly heterogeneous; this diversity is a crucial catalyst to Generative Emergence.</td>
</tr>
<tr>
<td>Molecular behavior is linear and deterministic.</td>
<td>Human behavior is non-linear, unpredictable and internally directed.</td>
</tr>
<tr>
<td>The experiment is initiated by a human agent who is external to the system.</td>
<td>Generative Emergence is always initiated by agents within the system.</td>
</tr>
<tr>
<td>Inputs of heat are exogenous to the system, coming from outside the container.</td>
<td>Inputs of energy and resources come from within the social ecology, they are endogenous.</td>
</tr>
<tr>
<td>Energy outputs are discarded (sent) into the environment. The chemical system cannot further utilize the heat that was dissipated.</td>
<td>Social systems utilize energy outputs in order to generate and regenerate the system.</td>
</tr>
</tbody>
</table>
This last distinction is perhaps the most important, namely the key output of a social system is the creation of value – something valuable to an agent in the ecology.  

Finally, the outcome Generative Emergence is a stable entity that can be generalized as a Dynamic State (Levie & Lichtenstein, 2010; Lichtenstein, 2011b). Briefly a Dynamic State has four components; these are:

A Substrate for Generative Emergence – a social ecology that include people, culture, technology, markets, sectors, social networks, and so on;

The driver of Opportunity Tension – a compelling opportunity and the motivation to pursue it (Fritz, 1989);

An Organizing Model – the core activities and method for creating value (see (Morris, Schindette, & Allen, 2003; Osterwalder, 2010);

All together these Create Value – in the form of products/services/activities. In economic terms, this value is exchanged for money, which (re)generates the Opportunity Tension and the Business Model, thus creating a generative loop, i.e. Generative Emergence.

In sum the Dynamic States Model presents all the aspects needed to understand Generative Emergence.

Chapter 9. Outcomes of Generative Emergence

Building on the work of other complexity researchers I’ve identified four possible outcomes to an emergence process. The most likely outcome – although one rarely mentioned by emergence scholars – is NOT emergence, i.e. the dissolution of the system. In the world of entrepreneurship this occurs all the time as unsuccessful attempts to launch, leading to the dissolution of the organizing project.

Achieving success in an organizing process can result in three increasingly strong degrees of emergence. First Degree Order Emergence refers to a pattern or structure within a system that arises and remains stable over time. Most computational emergence results in 1st-degree Order, as in NK Landscape models, or ‘gliders’ in the Game of Life simulation (Bar Yam, 2004). Although such order-creation is intriguing, it doesn’t confer much additional capacity to the system.

Second Degree Systemic Emergence occurs in the creation of a coherent system that displays qualitative novelty and non-reducibility, but does not include downward causation. Examples include the innovation of new processes in companies, and the creation (enactment) of new business opportunities. In both cases a system emerges but without the power to affect its components.

The strongest form of order creation is Third Degree Radical Emergence, the only form that expresses all five qualities of strong emergence: qualitative novelty, non-reducibility, mutual causality, structioning, and higher capacity. The result is an autonomous, self-generating social entity that creates value and is fully integrated into its social ecology. The prime example is the
creation of new companies, which from their start-up have a causal impact on their employees. Likewise is the re-emergence of a venture, whereby the new organizing model and value proposition have a significant role in defining the future behaviors of the founders and employees.

In sum, the process of emergence can lead to no emergence, or to 1st-degree, 2nd-degree, or 3rd-degree emergence. Each subsequent degree reflects greater system-wide impact, and greater capacity that’s conferred/created in the system. With this background we can apply the insights from Dissipative Structures Theory to real examples of organizational creation and re-creation.

**PART IV: THE FIVE-PHASE PROCESS MODEL OF GENERATIVE EMERGENCE**

Identifying this process has been a central goal of my research efforts since before my dissertation; examples of each phase are based on unpublished data from that study.

**Phase 1: Disequilibrium Organizing (Chapter 10)**

All Generative Emergence begins when a lead agent (a founder) experiences an *Opportunity Tension*, by envisioning a business opportunity that s/he is highly motivated to pursue. That motivation pushes her into action, organizing people and resources toward enacting/realizing the opportunity through a viable business, project, initiative or endeavor. The process pushes the system out of its norm and into ‘Disequilibrium Organizing.’ This chapter gives numerous examples of the Opportunity Tension that drove the entrepreneurs and companies in my study.

**Phase 2: Stress & Experiments (Chapter 11)**

As anyone who has organized something new can attest, the process is never easy; two qualities are sparked as a result. *Stress* occurs because the system is pushed into an arena of high pressure and great uncertainty. These stressors are felt as personal strain and sometimes interpersonal conflict, as participants struggle to deal with the intensity of the organizing effort. In addition many ventures experience *Fiscal stress* and financial challenges, primarily because of the efforts are being invested into make the leap, rather than on the production of revenues.

The parallel aspect of Phase 2 is *Experiments* – new ideas, spontaneous actions, and unique behaviors that are designed to deal with the intensity, to reduce the stress, to solve the challenges and capture the opportunity. Although most experiments are not fully pursued, one of them will become the seed of new order – the basic frame around which a new system can emerge.

**Phase 3: Amplification and Critical Events (Chapter 12)**

Up to a certain threshold of activity, the results of stress and experiments will be dampened by the system, which seeks to retain its current structure as much as possible. Beyond the threshold, however, these ‘fluctuations’ are amplified, leading the entire system to a *Critical Event*. This Critical Event is usually clear after the fact; retrospective sensemaking is used to explain the dramatic decisions that in some cases totally altered the system.
Phase 4: New Order through Recombination (Chapter 13)

The result of this Critical Event is *New Order* – something emerges or the entire effort dissipates into failure. If successful the emergent order accrues through a *recombination of elements* already in the system along with the acquisition of new resources from across the social ecology. These shifts are usually rapid, expressing punctuated change.

Phase 5: Stabilizing Feedback (Chapter 14)

One of the insights from this research is the role that Stabilizing Feedback have in retaining the New Order, and how Destabilizing Feedbacks can push the system back into a critical mode. These Stabilizing Feedback occur by strengthening new routines, developing formal ties with new stakeholders, or achieving certain goals. Such feedback processes are not described in dissipative structures theory; the fact that they can be seen in social situations offers an important example of how the transformative metaphor approach can double-back to provide insight into the original science (Garud & Nayyar, 1994).

*PART V: CYCLES OF EMERGENCE AND RE-EMERGENCE*

Chapter 15. Cycles of Emergence

My proposal is that these five phases are sequential, i.e. they follow a causal logic, a specific sequence in which each Phase occurs in close relation to the one before. Once the entire process has occurred, the system settles down into its new Dynamic State; it can then initiate the process again. Thus, the entire Five-Phase process is really a cycle, what I call a *Cycle of Emergence*. In this sense the new Dynamic State can become the preparatory sequence for the next Cycle. Once a Dynamic State emerges it may remain in place (even if growing incrementally) for many years.

This chapter presents two case studies that exemplify Cycles of Emergence. One describes the initial emergence of Starbucks, Inc, (Lichtenstein & Jones, 2004); the other is the emergence of the SEMATECH collaboration based on the analysis in (Browning et al., 1995).

The cyclic nature of emergence provides a much more dynamic view of organizations (as (Tsoukas & Chia, 2002) and (Leifer, 1989) suggested). Further, this frame is easily extended toward a new theory of organizational development in which companies grow through a series of Dynamic States rather than through stages in a Life Cycle (Levie & Lichtenstein, 2010). These implications are explored in Chapter 16.

Chapter 16. Cycles of Re-Emergence

The final step is to introduce the idea of Re-Emergence – the re-creation of an organization into a completely new Dynamic State. In a simple way Re-Emergence specifies the continuing Cycles of Emergence within an organization; first Emergence, then Re-Emergence, then Re-Emergence
again, and so on. However, such simplicity misses an extremely important distinction here, namely the difference between a Cycle of Re-Emergence and Organizational Transformation; This difference was described briefly above; in this chapter I provide more details to explain the difference between emergence and transformation, and why that difference makes a difference.

As mentioned above, transformation events are triggered by crisis, whereas emergence events are initiated by an aspiration to create or expand the potential of a company. Studies show that crisis is a reaction to events that seem to be outside the system; in contrast, creative action is a proactive process that draws mainly on internal resources and values. This is why proactive creativity is more likely to spur more innovation and more effective results (Axtell et al., 2000; Heinzen, 1994; Unsworth, 2001). Similar positive effects are found for proactive entrepreneurial logic (Newey & Zahra, 2009), self-directed entrepreneurial behaviors (Baron, 1998; Baron & Markman, 2003), and proactive thinking by entrepreneurs (Yusuf, 2012).

These differences are reflected in the actual week-by-week changes within the companies in my study. The analysis provides further insight into the subtle dynamics in the Cycle of Re-Emergence; these are referenced further in the following chapter.

**PART VI: FUTURE STUDIES OF GENERATIVE EMERGENCE**

**Chapter 17. Boundaries of Emergence, and Beyond the Boundaries**

“Boundaries” has two meanings, both of which are explored in this chapter. First, boundaries refer to the physical limitations of the container that holds a process. In the dissipative structures experiment the boundaries are the walls of the cylindrical vessel that holds the fluid and chemicals. It turns out that the dimensions of the boundary – literally the size of the experimental container – have an important influence on the outcome of the experiment (Goldstein, 2011; Swenson, 1997b). In a similar way, the constraints of a creative situation play a constructive role in any emergence process – as Juarrero suggests (Juarrero, 1999: 133), “constraints can simultaneously open up as well as close off options.” In this meaning boundaries are ‘constructive constraints’ which actually enable order to emerge. Thus, attending to the boundaries of an emergence process should have positive implications for our understanding and enactment of emergence.

Secondly, boundaries refers to the theoretical ‘Boundary Conditions’ of the model I have presented (Whetten, 1989). These boundaries allow me to specify which phenomenon should be explainable by the Five-Phase process model, and which not. In brief I will claim that the sequence of five phases is applicable to organizations as the unit of analysis. That is, I would expect the Cycle of (Re)Emergence to be valid for emergence in organizations or for the emergence of organizations.

The previous sentence holds four qualities that could be explored more fully, namely emergence within organizations vs. emergence of organizations; and emergence vs. re-emergence. Putting these qualities together as a two-by-two typology, suggests four avenues for continuing research in this field.
a. Emergence of Organizations is best represented by the PSED research on new venture foundings (Gartner, Carter, & Reynolds, 2004; Gartner, Shaver, Carter, & Reynolds, 2004).

b. Re-Emergence of Organizations refers to entrepreneurial ‘re-invention’ (Mullins & Komisar, 2009) (Baker & Nelson, 2005) which may also reveal insights into the mutability of an company’s identity (Gioia, Schultz, & Corley, 2000).

c. Emergence within Organizations can explore the range of emergences in organizational settings, including emergence of systems, departments, products/platforms, and even governance systems as has been done by (O'Mahony & Ferraro, 2007).

d. Re-Emergence within Organizations offers a unique lens to explore the re-creation of existing structures, systems or routines; it can also draw forward Strategy Process research gaining momentum in the academy.

Beyond these Boundary Conditions lie other empirical contexts in which the dynamics of Generative Emergence can be explored. For example some research in psychology and cognitive development suggests that several elements of a Cycle of Emergence may be expressed during major shifts in cognitive learning and leadership development (Boyatzis, 2008; Boyatzis & Kolb, 2000), or in aspects of creative flow experience (Csikszentmihalyi, 1990; Csikszentmihalyi, 1996). Another individual-level area worthy of exploration is whether the dynamics of personal projects, including creative projects (Fritz, 1991) might correspond to the five-phase process (Lichtenstein, 1995; Little, 1983).

The Five-Phase process model can be applied to increasingly more macro contexts, to see if and how it is validated in arenas such as the emergence of alliances and collaborations (Browning et al., 1995), ‘self-organizing supply chains (Choi et al., 2001; Pathak, Day, Nair, Sawaya, & Kristal, 2007), and network emergence (Biggiero, 2001). Broader contexts are also ripe for exploration around all the principles of Generative Emergence, including industry creation (Dew, Reed, Sarasvathy, & Wiltbank, 2011; Garud, Jain, & Kumaraswamy, 2002; Garud & Karnoe, 2003; Tan, 2007), the emergence of institutional clusters (Chiles & Meyer, 2001; Ehrenfeld, 2007), and the dynamics of institutional entrepreneurship (Maguire & Hardy, 2009; Maguire, Hardy, & Lawrence, 2004; Purdy & Gray, 2009).

Chapter 18. Enacting Emergence

Can emergence be intentionally pursued or enacted? This last chapter explores an ‘emergence praxis’ – three ways to instigate Generative Emergence. One way that a number of us have explored is to create the conditions for emergence in organizations (Goldstein et al., 2010; Hazy, Goldstein, & Lichtenstein, 2007; Marion & Uhl-Bien, 2001; McKelvey, 2004a; Osborn & Hunt, 2007; Uhl-Bien & Marion, 2008; Uhl-Bien et al., 2007). Specifically in one analysis, Donde Plowman and I (Lichtenstein & Plowman, 2009) summarized three studies on emergence to identify ten actions that leaders pursued throughout an emergence process. Examples include, Generate disequilibrium by embracing uncertainty, Encourage rich interactions through “relational space,” Support collective action, Accept tags, and Integrate local constraints. Together these behaviors of ‘Generative Leadership’ increase the likelihood that innovations can surface in social ecologies and companies, leading to emergence.
A second option is to enact each of the five phases of emergence in a cycle, with the aim of purposively generating an emergent entity. In brief, the process starts by Assessing the social ecology and current dynamic state, to identify possible collaborators, resources and synergies that can aid in the goal. Next is to Generate opportunity tension, and Pursue organizing that creates disequilibrium. Entrepreneurs then Allow for stress and welcome uncertainty, while Producing experiments that may become the seed for a new order. If these continue, momentum builds to a critical event, which may be chosen to define a moment of regime change. Next is Iterating emergence and Encouraging recombination of resources and elements, until a new order is found that truly increases the overall capacity of the system. Finally, if the new state is effective the generative leader applies Stabilizing feedback, to retain the sustainability of the system. To be clear, this description is a proposal which will require a good deal of experimentation to test and clarify.

The book concludes by making one more proposal, on the Emergence of Social Change. The idea is to combine Generative Emergence with (Gunderson & Holling, 2001)’s work on ecosystem resilience. Their research shows that natural and social ecosystems evolve through four phases of an ‘adaptive cycle.’ It turns out that these phases are extremely similar to the phases of Generative Emergence, with exploitation and conservation leading to a rigidity state, followed by a trigger that releases the resources, which then get re-organized and recombined into a new initial state. Linking the two models suggests a way to extend emergence to economic and natural ecosystems. In addition, the resilience framework emphasizes sustainability, which is itself a core value of Generative Emergence; both focus on building a healthy and viable world.
NOTES

1 This work originated with the classic paper by Katz & Gartner (1988), which eventually led to the NSF-funded Panel Study of Entrepreneurial Dynamics — the first randomized study of entrepreneurs in the world (See Gartner, Shaver, Carter & Reynolds, 2004), followed quickly by parallel data bases in Sweden. Studies showing the longitudinal process of organizational emergence are numerous; exemplars include: Carter, Gartner & Reynolds, 1996; Delmar & Shane, 2003; 2004, and Brush, Manolova & Edelman (2008), who proved the accuracy of the original Katz & Gartner model.

The first dynamic systems model of entrepreneurial emergence (Lichtenstein, Carter, Dooley & Gartner, 2007) showed that for nascent ventures which successfully emerged, the content of organizing behaviors (e.g. doing financial projections, doing marketing; finding funding, hiring first employee, and 24 others) was insignificant compared to the process of those behaviors, i.e. their temporal pattern over time.

2 Key work in this area has been done by Sarasvathy & Dew (2005) and Chiles and his colleagues: Chiles, Bluedorn & Gupta (2007), and Chiles, Tuggle, McMullen, Bierman & Greening, 2010. Tan (2007) showed that developing economies like China emerge in “phases” or cycles.

3 An influential simulation study by Krugman (1996) used a single-chained genetic algorithm model to show why populations of businesses tend to aggregate. This dynamic explanation was expanded in Chiles’s dissertation work, which showed the emergence of the Branson, MO music theater cluster occurred in four “cycles” of self-organization. (Chiles, Meyer & Hench, 2004).


5 Innovation: Brown & Eisenhardt; de Vany; Van de Ven et al. 1999;


7 Change/Transformation. Overviews in Weick & Quinn, 1999; Also, Bigelo, Dooly 1997; Levinthal 1991+, Lichtenstein 2000; Plowman et al., 2007. Tsoukas & Chia, 2002

8 The emergence of new social institutions has been empirical explored in studies of institutional entrepreneurship. For example, Maguire, Hardy & Lawrence (2004) explained the dynamics of emergence for a new institutional field in medicine; Purdy and Gray (2009) showed the emergence of the new field of Alternative Dispute Resolution; and O’Mahony and Ferraro (2007) studied the emergence of governance in Open Source Software projects. For a summary of the emergence paradigm in sociology, see Sawyer’s (2005) Social Emergence: Societies as Complex Systems.

9 Although my expertise is more limited for the field of psychology, several examples make this point clear. Some studies in neurophysiology have shown the unpredictably emergence of neural ‘subfields’ — see Poirier, Amin & Aggleton, 2008. Other examples are presented in Steven Stogatz’s Sync (2000 – see #4 above). One example of cognitive emergence is a recent study by McClelland and his students (McClelland et al., 2010), on connectionist and dynamical approaches to cognition. In terms of motivation, Guastello has been studying individual behavior using dynamic systems models for over two decades – these were summarized in his 2005 book, which shows how non-linear dynamic models can improve the explained variance in certain longitudinal studies by over 400%, from $r^2$ of .15 to $r^2$ of .60 and more. See also parts of Steven Strogatz’s Sync: How Order Emerges from Chaos in the Universe, Nature, and Daily Life. Finally, for studies on the collective nature of individual behavior see Amabile, Conti, Coon, Lazenby & Herron, 1996, and Sawyer & DeZutter, 2009.

10 The emergence of new social institutions has been empirical explored in studies of institutional
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11 The search included EBSCO-Host’s Academic Search Premier, EconLit, PsychArticles, SocIndex, ERIC, and Business Source Premier, on November 22, 2010. _Title includes the word “emerge*” and (organization or group or management or industry or market or entrepreneur* or economic* or neuro* or cognit* or decision or individual or social or collective or behavior). Limiters = peer reviewed._

12 The Five-Phase Process Model has been shown to explain emergences in work groups (Goldstein, 1998; 1994; Smith, 1986); organizations (Leifer, 1989; Nonaka, 1988; MacIntosh & MacLean, 1999; Plowman et al, 2007), start-up ventures (Lichtenstein, 2000; 2001; 2009), alliances and collaborations (Browning, . Beyer, ; Chiles, Meyer & Hench, 2004), and more.

13 McKelvey et al extend their analysis further, showing that because the NK-model is based in genetic biology, the connections between the agents are assumed to reflect epistatic connections between genes, which are always strong-tie effects. However, links between employees in firms are not always strong, in fact most important ties are weak. This leads to a second major challenge:

As far as we know, then, genes cannot turn epistasis on or off. But employees in firms can – they can choose how and when to interact with other employees. … But if employees can turn their interactions on or off, then the Kauffman-designed NK model clearly offers unrealistic simulations of organizational phenomena. [Thus we] challenge the NK-design a not being broadly applicable to organizations, as current applications of the NK model generally presume” (pg. 8).

14 Jeff Goldstein was the first person I found to use the term Prototype of Emergence, and he introduced me to the concept. Thus, the following analysis owes a great deal to him.

15 Types 2, 3, and 4 are based on Crutchfield (1994); Type 1 was added due to its prevalence in Organizational Science – see Maguire et al., 2006.

16 (Lichtenstein, 2000c; MacIntosh & MacLean, 1999; Nonaka, 1988; Plowman et al., 2007a; Smith & Comer, 1994), (Bettis & Prahalad, 1995; Goldstein, 1994; Leifer, 1989)

17 (Browning et al., 1995; Chiles et al., 2004),(Buenstorf, 2000; Foster, 2011; Foster & Metcalfe, 2012; Padgett & Powell, 2011; Tan, 2007)

18 (Juarrero, 1999; Lesourne, 1993) (Artigiani, 1987; Dyke, 1988; Gilstrap, 2007)

19 In other words, the new order incorporates all that was there (in the system), but it ‘transcends’ those components by producing new system-wide properties and structures that were unexpressed by the components alone. See (Koestler, 1979), also (Ashmos & Huber, 1987), and in philosophy, (Wilber, 1995)

20 This was done by dozens or researchers. These applications started just a few years after Bernard’s initial work, in the research by (Gibbs, 1906) and (Lotka, 1922, 1945). Later, Schrodinger’s classic book, “What is Life”, inspired (Odum, 1988; Odum & Odum, 1976; Odum & Pinkerton, 1955) and others to compute energy flows in ecosystems. Later, dissipative structures were applied to dynamic models of economics through efforts of (Georgescu-Roegen, 1971),(Boulding, 1978; Boulding, 1980, 1981), as well as (Odum & Odum, 1976), (Dyke, 1992), and (Rosser, 1992).
A moment’s reflection will show this to be true: The output – the aim – of every social system, is to create value, to someone (including the organizer). When that value is received by (other) agents, it is exchanged for something of value; in business terms the medium of exchange is money. The money that is received in the exchange is immediately used to (re)generate the system, i.e. to pay for employees, space, and the materials necessary to continue to generate the value – and so on. The overall result is an entity that continuously generates itself, a process well described by Weick, K. 1977. Organization design: Organizations as self-designing systems. Organizational Dynamics, 6(2): 30-46, Weick, K. 1979. The Social Psychology of Organizing (Second ed.). New York, NY: McGraw-Hill, Weick, K., & Roberts, K. 1993. Collective mind in organizations: Heedful interrelating on flight decks. Administrative Science Quarterly, 38: 357-381., Drazin, R., & Sandelands, L. 1992. Autogenesis: A perspective on the process of organizing. Organization Science, 3: 230-249, Tsoukas, H., & Chia, R. 2002. On organizational becoming: Rethinking organizational change. Organization Science, 13: 567-583. This self-generative quality thus defines the term Generative Emergence.

To give a bird’s eye view, a Dynamic State is a (model for a) social entity that is organized in order to create value – for the organizer(s) and/or for others. The value that’s created is transferred to those who want it, who exchange it for something valuable of their own – usually money. That money is utilized by the entity to produce more value; in other words, the money (literally) generates the entity. This recursive process is the essence of a Dynamic State, within which value is created that is exchanged for value (money) which is used to (re)generate the Dynamic State. The creation of this (autocatalytic) loop is Generative Emergence.

Even with this simplest of descriptions, a Dynamic States can be seen as an exemplar of strong emergence, for it includes all five of the necessary qualities. Specifically, a Dynamic State:

(a) Expresses qualitative novelty – in the unique output (product/service/offering) that includes but transcends its components, the people who make it up.

(b) Is not reducible to its components – it cannot be explained as the simple combination of organizing behaviors, nor the interactions across those behaviors (see Lichtenstein, B., Carter, N., Dooley, K., & Gartner, W. 2007. Complexity dynamics of nascent entrepreneurship. Journal of Business Venturing, 22: 236-261.; and

(c) Reveals mutual causality – because the emergent organization alters the behavior of its members, just as its members create and influence the development of the venture.

The emergence of a Dynamic State involves:

(d) structuring – an ongoing interdependence of agency and constraint. In particular, the founder (entrepreneur) identifies the ideal way to create value for a targeted market, in the most parsimonious way s/he can. Organizing is thus a co-creative process of effectuation and bricolage.

Finally, if the Dynamic State is to be sustained (sustainable), its emergence

(e) increases the capacity of the system in some way, either through efficiencies of scale, scope or learning, or through new organizing models that save time and are more effective at producing real and reliable value to customers.
REFERENCES


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