

University of Massachusetts Boston

ScholarWorks at UMass Boston

College of Management Working Papers and Reports

College of Management

1-16-2008

Entrepreneurship as Emergence

Benyamin B. Lichtenstein

University of Massachusetts Boston, b.lichtenstein@umb.edu

Follow this and additional works at: https://scholarworks.umb.edu/management_wp



Part of the [Business Commons](#)

Recommended Citation

Lichtenstein, Benyamin B., "Entrepreneurship as Emergence" (2008). *College of Management Working Papers and Reports*. 14.

https://scholarworks.umb.edu/management_wp/14

This Occasional Paper is brought to you for free and open access by the College of Management at ScholarWorks at UMass Boston. It has been accepted for inclusion in College of Management Working Papers and Reports by an authorized administrator of ScholarWorks at UMass Boston. For more information, please contact scholarworks@umb.edu.

**ENTREPRENEURSHIP
AS
EMERGENCE**

Benyamin B. Lichtenstein
University of Massachusetts, Boston
Department of Management and Marketing
Boston, MA 02115
617-923-3092
Benyamin.bml@gmail.com

January 16th, 2008

Submitted to the Annual Meeting of the
National Academy of Management, 2008

Entrepreneurship Division

UMBCMWP 1040

January 2008



ENTREPRENEURSHIP
AS
EMERGENCE¹

Benyamin B. Lichtenstein
University of Massachusetts, Boston
Department of Management and Marketing
Boston, MA 02115
617-923-3092
Benyamin.bml@gmail.com

January 16th, 2008

Submitted to the Annual Meeting of the
National Academy of Management, 2008

Entrepreneurship Division

Working Paper – PLEASE DO NOT QUOTE OR DISTRIBUTE

Target: AMR (Note) – Organization Science – Journal of Management Studies

Thank you for providing feedback on this draft!

¹ This paper has benefited greatly from the suggestions by participants in the Texas Tech Management Group's workshop "Exploring Emergence in Management" (Oct. 2007) and the Dardon-Lally Entrepreneurship Theory Retreat (2003), and by the insights of three anonymous and helpful reviewers. The ideas in the paper reflect rich complexity conversations with Bill McKelvey, Kevin Dooley, Jeff Goldstein, Russ Marion, and many others, and ongoing collegial support and connection with Bill Gartner, Dan Kim, Saras, and especially Tom Lumpkin. All errors and omissions are the responsibility of the author – please provide feedback to Benyamin.bml@gmail.com.

ENTREPRENEURSHIP AS EMERGENCE

ABSTRACT

Emergence is at the core of entrepreneurship research, which has explored the coming-into-being of opportunities, new organizations, re-organizations, and new industries, agglomerations, and so on. Emergence is also at the theoretical core of complexity science, which is essentially dedicated to exploring how and why emergence happens in dynamic systems (like entrepreneurship). This exploration begins by defining Opportunity In-tension as a dynamic interplay of personal agency and perceived opportunity, which is a catalyst for entrepreneurial behavior. Then I propose two insights about emergence, based on recent research in complexity science. First, a process theory for emergence is presented, which integrates Gartner's model of "organizing" with the Dissipative Structures Theory of order creation. Second, a definition for emergence is derived, which leads to a surprising notion that emergence can occur in "degrees" (i.e. 1ST-degree emergence, 2ND-degree emergence, and 3RD-degree emergence). Through this approach I suggest that entrepreneurship incorporates a much broader range of phenomenon than may have been previously thought. In a sense, by claiming emergence as a foundation for entrepreneurship, both disciplines can find new ground for research and application.

INTRODUCTION

Increasingly, emergence is being explored in entrepreneurship research. A focus on organizational emergence is exemplified in large-scale efforts to collect data on nascent entrepreneurs (Reynolds, 2000; Gartner, Shaver, Carter & Reynolds, 2004) and in studies of the start-up behaviors and effectual processes that lead to the emergence of new firms (Carter, Gartner and Reynolds, 1996; Sarasvathy, 2001). Emergence is also a core construct underlying the process of industry creation (Hunt and Aldrich, 1998) and the creation of new organizational communities (Van de Ven and Garud, 1989; Chiles, Meyer & Hench, 2004).

Given the importance of emergence to entrepreneurship, it is surprising that a formal definition of emergence has not yet appeared in the literature, nor have scholars proposed a process model for understanding and explaining how and when social phenomenon like nascent firms “emerge.” Without a definition of emergence, and absent a theoretical framework for exploring it, future research on the topic is likely to be scattered, making progress less direct and making it more difficult to build on each others work.

This paper offers one definition for emergence, and integrates two complementary process models into a framework for exploring many dimensions of entrepreneurial behavior. My approach will draw on some recent insights from complexity science that can inform our understanding of emergent phenomena across a broad range of behavior. In claiming that emergence is as central to entrepreneurship as it is to complexity, I am suggesting entrepreneurship may be able to stake a powerful claim to this rising research issue, and in the process, recognize that entrepreneurship explores a much broader range of phenomena than previously thought.

CONTEXT: OPPORTUNITY IN ENTREPRENEURSHIP

What is the Driver for Entrepreneurship

A good deal of progress has been made in exploring the nature of “opportunity” from a rigorous academic vantage. This effort – especially at recent Academy of Management conferences – has primarily been focused around the ‘objective-vs-subjective’ question: Is economic opportunity an objective phenomena which one can choose (or not) to capitalize on (Kirzner, 1997; Shane & Venkataraman, 2000), or is opportunity a subjective phenomenon, such that opportunities are created by the entrepreneur through her/his interactions in a context (Sarasvathy, 2001; Alvarez & Barney, in press)? Regardless of the outcome of this debate, framing entrepreneurship around the phenomenon of opportunities has helped integrate various perspectives and is leading to some productive research streams around novelty, innovation, and value creation.

However, there are two fundamental problems with focusing on opportunities per se, as a core of entrepreneurship research (Shane & Venkataraman, 2000). First, opportunities are not unique to entrepreneurship: The identification of opportunities is a central concern for strategic management, leading to entrepreneurship becoming an increasingly important element of strategy (e.g. Meyer & Heppard, 2000) and organization theory (Schoonhoven & Eisenhardt, 2001). Not only does this limit the distinctiveness of entrepreneurship as a field of study, it also limits the insights that entrepreneurship can provide to our sister disciplines in management and throughout the social sciences.

Perhaps more importantly, if in theory entrepreneurship is about opportunity, then in practice entrepreneurs should be focused around the discovery and exploitation of opportunity. As such, the “Shane/Venkat” hypothesis could be empirically tested to prove (or disprove) the

primacy of opportunity for entrepreneurs. Specifically, given a random sample of nascent entrepreneurs – those individuals who say they are attempting to start up a business – the vast majority should say that the driver of their activities – what animates their pursuit of entrepreneurship, is to capitalize on an opportunity they’ve identified in some market.

Such an empirical test is feasible, and in fact has already been accomplished. The PSED (Panel Study of Entrepreneurial Dynamics – see Gartner, Shaver, Carter & Reynolds, 2004) is a random sample of over 1000 nascent entrepreneurs starting businesses in America. Answering the question “Which came first for you, the business idea or your decision to start some kind of business,” nearly two-thirds of respondents said that the “decision to start” was primary (including those who said their desire to start was simultaneous with identifying an opportunity). In contrast – and in a surprising disproof of the primacy-of-opportunity approach, only 36.9% replied that the opportunity alone came first (Hills & Singh, 2003, pg. 266).

These findings strongly suggest that opportunity per se may not be the primary locus or driver of entrepreneurial behavior. Of course, more recent scholarship have argued persuasively that “value creation” is the core of the discipline, and that entrepreneurial behavior is driven by the possibility of creating new value (Busenitz, et al., 2003).² Although this is an important advance, it still leaves open the question of “activation” – what or where is the *driver* of value creation activity? Is it the entrepreneur? Is it the environment? Is it both? How?

“Opportunity In-tension” and Entrepreneurial Activation

An intriguing alternative was given by McKelvey (2004), in his complexity-science

² Dear reviewers. I recognize this is a very weak connection to value creation, which I agree (thanks to recent conversations with my colleagues) is already recognized as a better approach. However, as I am ‘on deadline’ I simply make reference to that framework, and ask you to help me decide how to integrate, frame, and so on.

framework for entrepreneurship. McKelvey argues that the catalyst of entrepreneurship is “adaptive tension” – a creative tension (Fritz, 1989) that generates adaptive behavior for the system. Adaptive tension, in his view, occurs in the presence of an environmentally imposed “energy differential” between the firm and its environment, i.e. a discernable difference between existing resources or energy levels within the firm and a pool of resources or level of potential energy that is outside of it. This differential generates a pressure to act – literally the energy differential puts the firm into a disequilibrium state, and a disequilibrium always seeks to be dissipated. From this thermodynamic view (Prigogine, 1971; Prigogine & Stengers, 1984), this disequilibrium *activates* entrepreneurial behavior, i.e. the adaptive tension sparks entrepreneurial agency in the form enacting an opportunity, starting a venture, transforming a company, creating value.

Entrepreneurship in this view is catalyzed and driven by adaptive tension. The result of this activation is the creation and emergence of something new; emergence *is* “order creation.” (See McKelvey, 2004 for a complete thermodynamic explanation of the theory, and its relevance to a disequilibrium economics.) Order creation is defined by novelty; the result of emergence is always something new and valuable for the system (Goldstein, 1999).

Others (Lichtenstein, Carter, Dooley & Gartner, 2007: 255) have built on this idea, defining adaptive tension as,

...an internal state of creative tension sparked by some external trigger. In this view, opportunities are developed out of an adaptive tension, and once developed they become a catalyst for future business creation activities. We thus suggest that adaptive tension offers a more basic theoretical reason for why nascent entrepreneurs start organizing.

Pushing this argument further, I would suggest the term “Opportunity In-tension” for explaining the onset of entrepreneurial activity. Drawing on McKelvey’s complexity approach,

opportunity represents potentiality – as occurs in an unexploited set of resources, an unfulfilled potential, an untapped market. Opportunity is thus not an objective situation which may be differentially assessed and exploited (Shane & Venkataraman, 2000). Instead, opportunity is *interdependent* with the individual(s) who realize it – entrepreneurs who create a commitment (intention) and begin to organize the opportunity into a reality. Opportunity In-tension shifts attention from the opportunity per se to the broader process of new value creation. Again, having perceived an energy potential in the environment, a successful entrepreneur “learns how to import these energy potentials [to] create an organization that transforms [these] resources into goods and services which have value for customers” (Lichtenstein, et al., 2007: 241).

When Opportunity In-tension becomes realized, the tangible result is the emergence of something new. Emergence thus provides a specific framework for entrepreneurial success. More than cultivating good business ideas, and more than the ability to identify an objective economic opportunity, most of us who teach entrepreneurship focus on encouraging our students to work out the details of a potential business model *in practice*, and to do the legwork that literally begins to make “it” *happen* – that brings their venture into emergence. As such, ***emergence is an “embodied” process that leads to the generation of something new.*** This process has been described in many ways, including “acting as if” (Gartner, Bird & Starr, 1992), “effectuation” (Sarasvathy, 2001), and “opportunity creation” (Alvarez & Barney, in press).

Emergence in some way mitigates the debate around opportunity by shifting the conversation toward the process, rather than the content, of entrepreneurial action (Van de Ven & Engleman, 2004). In so doing we avoid the either-or problem of “discovery versus creation” (Alvarez & Barney, in press), while providing a lens for exploring the entire range of

entrepreneurial behavior – emergence across many levels of analysis and action. In the same way (but perhaps to a lesser extent), emergence can offer a tangible process model for explaining how value is created – what are the underlying dynamics of new value creation.

Overall, my aim in this paper is to offer two insights about emergence. First, I will propose a *process model* for emergence. This model will integrate the processes that have been shown to generate emergence: (1) “Organizing” in the “Gartnerian” sense (Gartner 1993; Gartner & Brush, 2007), and (2) the dissipative structures theory of order creation (Prigogine & Stengers, 1984; Lichtenstein, 2000a; McKelvey 2004; Chiles, Meyer & Hench, 2004). Second, I will propose a *definition* for emergence which rests on the process approach. This definition leads to the notion that emergence happens in degrees, i.e. there may be different “degrees” of emergence that result from this integrated process. Together these insights offer the outlines of a framework for exploring entrepreneurship as emergence.

EMERGENCE AS A PROCESS

Gartner’s “Organizing” Model of Emergence

Bill Gartner has for many years led our discipline in thinking about entrepreneurship as “Organizing in the ‘Weickian’ sense” (Gartner, 1988; 1993; 2001). In his recent essay with Candy Brush (Gartner & Brush, 2007: 2), they provide a useful description of the process:

Emergence is a cycle of activities between enactment and selection... This framework [of emergence] has a subtle but significant difference from the organizing model described by Weick [of variation or enactment – selection – retention], because it includes a feedback loop between enactment and selection.

This feedback loop is indeed important, for it sets up an iterative process – a cybernetic process (Maruyama, 1963) – which can accelerate and gain momentum, leading to emergence. Of course, the process can also oscillate, or decelerate, or follow any number of patterns (Bygrave

& Hofer, 1991). Moreover, Gartner's addition of the temporal dimension to organizing has led to many surprising findings, including other results from the PSED regarding "semi-survivors" – nascent entrepreneurs who continue organizing for years and years as years, always saying they are "still working on it" but never quite finishing (Gartner & Carter, 2004).

Their further explanation provides an account of the "organizing" of new ventures:

Organizational emergence is where vision, which connects possibilities, moves from vague to clear...taking on form and meaning.... The value associated with the new reality is being discovered and exploited. This process involves the entrepreneur's perception of opportunity structures, or gaps in the market, that are met by acquisition and the management of resources and information-networks.

Essentially organizing makes vision real through an ongoing iteration between the enactment of the entrepreneur – specific actions that 'test' the landscape, 'effectuate' an idea, 'create' an opportunity – and the responses from the environment which give clues to the astute organizer of which behaviors to select and drive forward. Over time, this enactment → selection → enactment → selection process leads to the emergence of a structure – the value that is derived from the opportunity created by/through the entrepreneur. Organizing thus leads to the creation of new structures – organizations – within a specific organizational field or network.

Prigogine's Dissipative Structures Theory of Emergence

An alternate – yet complementary – view of emergence process was developed by Nobel Prize Laureate Ilya Prigogine (1971) for his Dissipative Structures Theory of order creation. His thermodynamic experiments, which extended the unique work of Bernard (1901), found that macroscopic structures would spontaneously emerge ("self-organize") when a system was pushed to a far-from-equilibrium state. Further work (Nicholis and Prigogine, 1989) identified a process for this order-creation process, involving:

1. Pushing the system into a **far-from-equilibrium state**;
2. **“Fluctuations”** or “perturbations” that experiment with dissipating more energy through the system, one of which gets amplified through a non-linear, positive feedback loop;
3. A “nucleation” process takes place whereby the initial **seed of order gets instituted throughout the system, re-organizing the components** into macro structures.
4. This **new order is stabilized**. It has the capacity dissipate orders-of-magnitude more energy through the system.

Applications of “self-organization” rapidly disseminated into the management literature, sparking numerous articles and compilations on how to create self-organizing processes (Weick, 1977; Ulrich & Probst, 1984; Goldstein, 1996; Smith, 1986). Although much of that literature has lay dormant (Ashmos & Huber, 1988), the four-fold process been replicated in numerous key articles. For example, Nonaka (1988) used “intensive case study analysis” to explore how knowledge “self-organizes” in organizational renewal; he found that this order creation occurred through four interrelated processes: (1) Creation of Chaos; (2) Amplification of fluctuation; (3) New Order and Restructuring of Organizational Knowledge; and (4) Dynamic Cooperation to Resolve Discrepancies.

Similarly – yet in a very different unit of analysis – Browning, Beyer & Shetler (1995) examined the unprecedented emergence of SEMATECH, the large-scale alliance of 1990s leaders in the semiconductor industry. In their discussion they re-view the process using the Dissipative Structures Theory, enabling a more dynamic explanation, in their terms, of: (1) Irreversible Disequilibrium; (2) Self-organizing Processes; (3) A New Order; and (4) the extension of the consortium, an evident measure of Feedback from the system.

Please See Table 1:
Four Sequences of Dissipative Structures Theory, Across Multiple Studies

More recently, Plowman and her colleagues (Plowman et al., 2007) researched the genesis of a new emergent order at “Mission Church,” analyzing the radical transformation there and the resulting value that’s been created over the past decade. They too utilize the Dissipative Structures Theory in defining their four constructs of emergence: (1) Far-from-equilibrium conditions; (2) Amplifying Actions; (3) Resource Aggregations; and (4) Negative (stabilizing) Feedback.

As Table 1 shows, these four sequences of emergence have been identified and replicated in multiple levels of analysis in entrepreneurship, including new venture emergence (using the PSED), emergence of a high-potential firm (“radical entrepreneurship”), strategic change and organizational renewal in large companies (Nonaka’s Knowledge Creation); radical organizational change (at Mission Church), alliance formation (SEMATECH), and emergence of a regional agglomeration (Branson, MO). In sum, it appears that a formal process theory may exist for emergence,³ incorporating four interlocking sequences of action:

- 1. Dis-equilibrium Organizing**
- 2. Amplifying Actions**
- 3. Novelty through Resource Interdependence and (re) Aggregation**
- 4. Stabilizing Feedback**

These four sequences occur in a process that is partially sequential and fully interdependent. They are sequential in that, for example, Amplifying Actions are only likely in the presence of Dis-equilibrium Organizing (e.g. Opportunity In-tension); likewise, Novelty is created (“Aggregated”) only through a seed that emerges through Amplifying Actions, and so

³ This insight requires a full-length paper to work through, and I am giving such a paper at the Organization Science Winter Conference. Absent that full treatment here (due to space limitations) I can only put forward 4-fold process as a proposition, knowing it requires a good deal more explanation.

on. At the same time – and especially in social systems which incorporate many interlocking levels of analysis and networks in constant interaction – aspects of these four sequences have been identified at virtually every point in order creation processes. (See Chiles et al., 2004 and Plowman et al., 2007 for rich demonstrations of this interdependency).

Integrating a Process Theory of Emergence

Overall, my argument is based on a process question: *How does entrepreneurial activity get activated?* According to complexity science, the driver or catalyst of entrepreneurial behavior is a dynamic which I’m calling “Opportunity In-tension.”

Opportunity In-tension is the active duality involving the *perception* of a pool of potential resources (i.e. possible value for a target market), and *passion* this perception activates in the entrepreneur. When this disequilibrium generates a creative tension in the individual – the intent to ‘start a business’ or organize in any form – this Opportunity In-tension leads to a series of organizing activities (Gartner et al., 2004), entrepreneurial behaviors (Gartner et al., 1992), organizing moves (Lichtenstein et al., 2006), and so on.

Here commences one of two processes. Gartner’s two-part process involves the interplay of enactment \leftrightarrow selection, which iterate over time, leading to the emergence of a new organization. This iterative process is at the center of the Dissipative Structures Theory, embedded within Amplifying Actions and Resource (re) Aggregations. The Dissipative Structures Theory also recognizes Opportunity In-tension as an important form of disequilibrium organizing. The theory then shows how fluctuations – literally “experiments” from within the system – will be amplified due to direct positive feedback from their immediate environment. As this seed is amplified – through further “enactment” by the entrepreneur (agent) – it gains momentum, leading to resource reorganizations and order creation that are

increasingly selected due to their positive outcomes in the system. These outcomes continue to feed back through the system, ultimately leading to legitimization and stabilization (retention). Although complexity experts will see some intriguing differences that my integration intentionally masks, the connection is clear enough to make the following claim: Gartner's process model of emergence as "organizing" is quite similar to the process model of emergence given by Dissipative Structures Theory; thus, they can be integrated in a general way.

With the outlines of this process model in place, the next step is to define emergence, i.e. provide an operational definition for what is really happening as a result of the process.

DEFINING EMERGENCE

For over 100 years the question of "what is emergence" has intrigued *philosophers* (Lewes, 1877; Popper, 1926; Stephen, 1992), *evolutionists* (Darwin, 1859; Morgan, 1923; Fisher, 1930; Eldredge and Gould, 1972; Kauffman, 1993; Salthe, 1993), *complexity scientists* (Prigogine, 1955; Allen, 1975; Holland, 1988; Nicolis and Prigogine, 1989; Crutchfield, 1994; Mainzer, 1994); and a wide range of *management scholars* (Selznick, 1943; Homans, 1950; Burns and Stalker, 1961; Weick, 1977; Goldstein, 1986; Stacey, 1992; McKelvey, 1997; Malnight, 2001; Chiles, Meyer & Hench, 2004). One early definition of emergence was developed in 1938 by sociologist Herbert Mead:

When things get together, there then arises something that was not there before, and that character is something that cannot be stated in terms of the elements which go to make up the combination. It remains to be seen in what sense we can now characterize that which has so emerged.
(Quoted in Mihata, 1994:30).

Over time, as scholars have attempted to "characterize that which has so emerged," most of those characterizations have revolved around the notion of "qualitative novelty." Qualitative novelty can be formally defined as the coming into being of a new (qualitative)

level of order that is unexpected or novel in some way (Websters, 1996: 795, 955). For example, the evolutionary emergentists, developed an explanation of the qualitative novelty that represented in successive levels of reality (Blitz, 1992). In Newman's (1996: 247) words, "For an emergent evolutionist, a property of a system is emergent if its existence is novel at the level of evolutionary or physical complexity in which the system is found." This definition became one basis of systems theory, which identified the various "levels of reality" which are explored by different sciences (e.g. Miller, 1978; Boulding, 1988) including organization science, which is attempting to explore interactions across multiple "levels of analysis" (Rousseau, 1985; Davidsson & Wiklund, 2001). Thus, Mihata (1997: 31) provides a useful summary of previous reviews of emergence in sociology and management:

The concept of emergence is most often used today to refer to the process by which patterns or global-level structures arise from interactive local-level processes. This "structure" or "pattern" cannot be understood or predicted from the behavior or properties of the component units alone.... In the doctrine of emergence, the combination of elements with one another brings with it something that was not there before.

Although much of this definition is already familiar to us, Mihata and others highlight a crucial distinction which expands the notion of emergence in significant ways. Emergence does include the creation of a "new level" of reality – as represented in the five "levels" of entrepreneurial organizing. However, emergence also refers to "patterns or global-level structures" in dynamic systems. These patterns may occur *within* a level of analysis, rather than creating a new level (Lichtenstein, 2007). For example in the studies of emergence based on Kauffman's "NK landscapes" model (e.g. Gavietti & Levinthal, 2000), what "emerges" is a network structure of interaction that defines more adaptive versus less adaptive combinations of attributes (McKelvey & Lichtenstein, 2007). This expanded notion of emergence is reflected in Goldstein's (1999: 49) definition of emergence, which I see as one of the most

comprehensive and useful for management and entrepreneurship: “Emergence...refers to the arising of novel and coherent structures, patterns, and properties in...complex systems.”

For example, Lichtenstein, Dooley & Lumpkin (2006) use this broader approach to define an “emergence event” as a system-wide shift across three “modes” or patterns of organizing within one nascent venture whereby “a coordinated and punctuated shift in multiple modes of entrepreneurial organizing [occurs] at virtually the same time, which generates a qualitatively different state – a new identity – within a nascent venture.” This new state is not a new level of analysis, yet with this emergence comes new properties and characteristics that significantly affect the next phases of nascent organizing.

In other words, emergence as a process and may include more than one type of outcome. The strongest type of emergence is the creation of a new “level of reality” as defined by systems scientists. Less strong would be emergence as the creation of new properties within a specific level. Following this line of thinking, I follow Goldstein’s (1999) argument that there are a “continuum” of definitions for emergence.

THREE DEGREES OF EMERGENCE

In the most basic sense emergence can be defined in terms of novel *properties or structural order*. The presence of these characteristics reflects the “first degree” of emergence – the least strong type. The second degree of emergence reflects a stronger form, namely the coming-into-being of a new level of analysis through the interactions among its lower-level components. Beyond the existence of a higher-level system, a 3rd degree of emergence includes properties that supervene on – i.e. influence or govern – the behavior of the components themselves. Finally the fourth and strongest degree of emergence occurs when a single principle or effect – a “power law” that reflects a “scale-free” theory – generates in a

single context multiple levels of emergence which are all connected. For example, Stanley and his colleagues (1996) find that a single scaling law accounts for the relationship between growth rates and internal structure of U.S. manufacturing companies between 1975 and 1991, across more than seven orders of magnitude (i.e. from companies with 10 employees to those with more than 100,000).

Following the basic findings from systems science (Miller, 1978; Boulding 1978; 1988), I propose that each of these four degrees of emergence is more inclusive than its predecessor. According to this logic, and following the original insight from Goldstein (1999), each of these four degrees of emergence can be arranged on a scale of emergence. Each of these four types are briefly summarized below.

1st-Degree Emergence: Creation of Internal Order

This first degree of emergence is exemplified in the formation of entrepreneurial regions like Silicon Valley in California (Saxenian, 1996), or Silicon Alley in the New York area (Lant, 2000). In both cases the emergent capabilities and resources in the region were catalyzed through a vast array of interactions across levels. Due to the non-linearity inherent in complex systems (Dyke, 1988; Holland, 1995), small actions can become magnified, sparking positive feedback loops through which new and surprising types of order emerge in the system (Arthur, 1990). For example, the remarkable rise of Internet-related businesses in the New York tri-state area can be described in terms of the path-dependent interactions between the component agents in the area. These non-linear interactions generated novel structural properties in the region that were essentially non-deducible (analytically intractable) from even a thorough knowledge of the original components in the region. In this “entrepreneurial system” of Silicon Alley, several new structures have emerged, including the presence of media

focused on the region (Alley Cat News, Silicon Alley Radio Station), the creation of a trade association (New York New Media Association), and the emergence of a rich entrepreneurial network that created 250,000 new full-time jobs (Arikan, 2001). The coming-into-being of this unexpected system-wide structural order reflects the first type of emergence.

2nd Degree Emergence: Creation of a New Level of Order

The second degree of emergence relies on a stronger definition of qualitative novelty, namely the coming-into-being of a coherent entity (i.e. an agent) that is qualitatively different from the components that make it up (Crutchfield, 1994). More than the emergence of properties or order *within* a system, this type is based on the emergence of a semi-autonomous entity that exists at higher level of analysis than its components, but is constituted solely by those pre-existing components and their interactions (Salthe, 1989; Schröder, 1998).

An example of this degree of emergence is the successful start-up of a new entrepreneurial venture. As scholars have shown, the pre-launch period of nascent entrepreneurship is composed of a stream of enactments and start-up behaviors that are intended to make the organization “known” to its environment (Gartner, Bird and Starr, 1992; Sarasvathy, 2001). The components of the “pre-organization” system include various types of human and social capital (Cooper, Gimeno-Gascon and Woo, 1994; Dollinger, 1995), a set of start-up behaviors (Carter et al., 1996), or the components of a new technological invention (Fleming and Sorenson, 2001). At some point in the process of organizing, combining and/or enacting these components, the entrepreneur denotes that the nascent company has “started;” at that point the business firm emerges as a semi-autonomous agent within a particular industry. This emergence reflects the creation of a new level of order – the interdependent components have become a firm. Once emergent, the firm “transcends yet includes” the properties of its

components, i.e. it maintains the characteristics derived from the components of the nascent period, while at the same time produces a totally different set of behaviors, including for example the legal recognition of its identity, and new types of interaction – with competitors, partners, and other agents in its industry. This shift from emergence to existence is well described by Gartner, Bird and Starr (1992: 15, 17):

The differences between emerging and existing organizations are not ‘differences in degree’ across certain dimensions, but quantum differences between the two types... The process of change from the emerging organization to the existing organization is not the ‘growth’ of certain variables, but an entirely new reconstitution, a ‘gestalt’...

The coming-into-being of a new level of order, an entity at a higher level of analysis, defines this “gestalt,” which is denoted by the second type of emergence.

3RD Degree Emergence: A New Level of Order *with* Supervenience

An even stronger way to characterize emergence is through the concept of supervenience, whereby the emergent entity exerts some degree of influence or constraint on its components. This view was first expressed by Morgan (1923), who viewed evolution as a creative process in which higher-order processes “supervened,” i.e. acted on, lower level ones. Embedded in this idea is the concept of “downward causation,” referring to the way in which higher-level emergent processes causally influence their lower level constituents (Blitz, 1992). Sperry’s (1986: 267) theory of “macro-determinism” expresses this idea in a strong way:

[T]he fate of the parts from that time onward, once a new whole is formed, are thereafter governed by entirely new macro-properties and laws that previously *did not exist*, because they are properties of the new configuration.

One example of this type of emergence is the birth of a new industry or industry segment. Like the previous type of emergence, a new organizational population exists as a new level of order as compared with the individual organizations within it; this exemplifies the

emergence of a new level in the entrepreneurial hierarchy. Moreover, the birth of an industry generates numerous industry-level properties that constrain and govern the behavior of component firms. For example, Aldrich (1999, Chapter 9) has suggested how the strategies facilitating industry emergence necessarily affect organizational-level processes of learning and legitimacy. Separately, Low and Abrahamson (1997) show how an emerging firm's organizing tactics and internal structure may be determined by the rate at which a new industry is forming. Note that these supervenient effects occur as the industry is emerging (co-evolving), long before the effects of institutional norms (DiMaggio and Powell, 1983), industry archetypes (Greenwood and Hinings, 1993) and the dynamics of density-dependence (Carroll, 1988) become salient. The co-evolutionary creation of a new industry illustrates the third type of emergence.

4TH Degree – Scale-Free Emergence

Many complex systems – resulting from emergent dynamics – tend to be '*self-similar*' across levels. That is, the same process drives order-creation behaviors across multiple levels of an emergent system (Casti, 1994; West *et al.*, 1997). These processes are called '*scaling laws*' because they represent empirically discovered system attributes applying similarly across many orders of magnitude (Zipf, 1949). *Scalability* occurs when the relative change in a variable is independent of the scale used to measure it. Brock (2000, 30) observes that the study of complexity "...tries to understand the forces that underlie the patterns or scaling laws that develop' as newly ordered systems emerge." These underlying scaling laws represent the 4TH degree of emergence.

Power laws seem ubiquitous – they are found in ranges from atomic nanostructures ($\sim 10^{-10}$ meters) to galactic megaparsecs ($\sim 10^{22}$ m) – across a range of 32 orders of magnitudes

(Baryshev and Teerikorpi, 2002). In biology, West and Brown (2004) demonstrate a power law relationship between the mass and metabolism of virtually any organism and its components – based on fractal geometry of distribution of resources – across 27 orders of magnitude (of mass). Brock (2000) says scalability is the fundamental feature of the Santa Fe Institute’s approach to complexity science. McKelvey argues that most, if not all, of the interdependence-based power law theories apply to management research (McKelvey & Andriani, 2005). There is good reason to believe that power law effects are also ubiquitous in organizations and have far greater consequence than current users of statistics presume (Adriani & McKelvey, 2007).

ENTREPRENEURIAL EMERGENCE ACROSS SUCCESSIVE LEVELS

By now it should be somewhat clear that the levels of analysis which are such an important part of entrepreneurship research (e.g. Low & MacMillan, 1988), are themselves *created* through an emergence process. More strongly, according to dynamic systems theory, each “level of analysis” in social systems is the result of 3RD-Degree Emergence, which leads to a higher level order that transcends yet includes its components. In this way, for example, entrepreneurial networks represent emergent order made up of its component individuals; entrepreneurial organizations represent emergent order made up of entrepreneurial actions and resources, and so on.

As one would expect, these levels are quite similar to the levels of social reality as originally defined by systems scientists (e.g. von Bertalanffy, 1968; Miller, 1978; Boulding, 1988), who have identified specific levels of social systems (beyond cells and organs – Miller, 1978). According to the theory, each successive level in this nested system (termed a “holarchy” – Koestler, 1979) includes the capacities of the previous level (i.e. the components that make it up), and then adds its own unique and more encompassing capacities (Ashmos and Huber,

1987). In this way each new level transcends yet includes its predecessor components (Koestler, 1979). Table 2 presents the set of levels in social systems, and shows how each level corresponds to specific contexts of entrepreneurial organizing and research.

Please See Table 2 – Levels of Entrepreneurial Organizing

Complexity science helps us understand that each level of analysis is really a context of entrepreneurial organizing that is continuously created and recreated over time. Networks are always emerging through agent interactions, just as potential entrepreneurial teams are constantly organized at the intersection of opportunity, networks, and agency. Likewise, industries are always emerging – albeit much more slowly – and declining as well, just as regions emerge and may shift over time.

Thus each of these levels of organizing are sites for further emergence. Note, however, that emergence happens in degrees. Thus, each level can be distinguished as a context for 1st Degree Emergence, 2nd Degree Emergence, and 3rd Degree Emergence.⁴ The result is a kind of matrix of possible research into entrepreneurship as emergence, shown in Table 3. Most of these contexts are well-known contexts of entrepreneurial scholarship, yet some cells in the matrix reflect organizing processes that are not often (but could) be termed entrepreneurial.

PLEASE See Table 3:
Entrepreneurial Action across the Three Degrees of Emergence

CONCLUSION

⁴ Technically, scale-free emergence would incorporate all levels, but no scale-free theory has yet been found that achieves this goal.

This paper set out to reframe entrepreneurship as the study of emergence – and show how the science of emergence produces some very useful constructs that can lead to a new era of research in entrepreneurship. A process theory of emergence was developed from Gartner’s “organizing” and from Dissipative Structures Theory, which I endeavored to integrate into a relatively parsimonious model of four interdependent sequences. This led to a broader definition of emergence that suggests there it occurs in increasingly significant degrees: 1st-Degree Emergence, 2nd-Degree Emergence, 3rd-Degree Emergence, and Scale-Free Emergence. Ultimately this leads to a much more expanded view of entrepreneurship activity, across multiple levels of analysis and process. Although entrepreneurship scholars have long identified entrepreneurship with process (Schumpeter, 1934; Gartner, 1985; Bygrave & Hofer, 1991; Bhavé, 1994; Van de Ven et al., 1999; Bhidé, 2000), this is the first time that a specific theory-driven process of has been proposed to cover multiple levels of entrepreneurial organizing.

A good deal more work is required at this point, of course, and there are many limitations to the foregoing analysis. First, my outline of Dissipative Structures Theory as a formal process of four interrelated sequences is not formally confirmed in any way; this is the first time anyone has attempted to make this kind of argument. Similarly but to a lesser extent, my approach for integrating Gartner’s organizing process into the Dissipative Structures model is a proposition at best, and in the accompanying footnote I admit there are some important differences awaiting more exploration. Another limitation involves my definitions for emergence, which are based on my own understanding of philosophy and systems science, garnered over my 27-years of study into complexity science. Others have interpreted this scholarship differently. Finally, my distinctions of emergence into four degrees is untested.

My hope is that this paper begins a dialogue that can expand our understanding of these topics, ultimately leading to a parsimonious version of the emergence continuum.

If these limitations can be mitigated through future drafts of this work, the emergence approach provides some unique contributions to the field of entrepreneurship. Using rigorous philosophical logic to define the nature of emergence provides a novel framework that can help distinguish entrepreneurship as a distinctive domain of management and social science research. Further, identifying four degrees of emergence offers a general framework for future research that can help theorists and empirical researchers to build on each others work, thus increasing our progress toward understanding this complex phenomenon. Finally, linking entrepreneurship to complexity science, with its rapidly advancing in methodological sophistication and organizational application, leverages the insights that both fields have gained in exploring the holistic emergence of structure and pattern in dynamic, agent-based, interactive systems (Stevenson and Harmeling, 1990; Bygrave and Hofer, 1991). If carefully operationalized and harnessed, complexity science may provide an elegant structure on which to build and empirically test comprehensive theories of entrepreneurial emergence.

REFERENCES

- Aldrich, H., 1999. *Organizations Evolving*. Newbury Park, CA, Sage Publications.
- Andriani, P. & McKelvey, B. 2007. Beyond Gaussian Averages: Redirecting Organization Science toward extreme events and power laws. *Journal of International Business Studies*, 38 (Nov.Dec).
- Arikan, A., 2001. "A complexity approach to entrepreneurial system emergence: The case of Silicon Alley", New York University.
- Arthur, B., 1990. "Positive feedbacks in the economy." *Scientific American*. February: 92-99.
- Ashmos, D. and G. Huber, 1987. "The system paradigm in organization theory: Correcting the record and suggesting the future." *Academy of Management Review*. 12: 607-621.
- Alvarez, S. & Barney, J., in press. Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 2008 – forthcoming.
- Baron, R. 2004. The cognitive perspective: A valuable tool for answering entrepreneurship's basic "why?" questions. *Journal of Business Venturing*, 19: 221-240.
- Baron, R. & Markman, G. 2003. Beyond social capital: The role of entrepreneurs' social competence in their financial success. *Journal of Business Venturing*, 18: 41-60.
- Baryshev, Y. and Teerikorpi, P. 2002. *Discovery of cosmic fractals*. New Jersey: World Scientific
- Bénard, H. 1901. Les tourbillons cellulaires dans une nappe liquide transportant de la chaleur par convection en régime permanent. *Annales de Chimie et de Physique*, 23: 62-114.
- Bhide, A. 2000. *The Origin and Evolution of New Business*. N.Y.: Oxford University Press.
- Blitz, D., 1992. *Emergent Evolution: Qualitative novelty and the Levels of Reality*. Boston, MA, Kluwer Academic.
- Boulding, K. 1988. *The world as a total system*. Thousand Oaks, CA: Sage.
- Boulding, K., 1978. *Ecodynamics: A New Theory of Societal Evolution*. Newbury Park, CA, SAGE.
- Brock, W. A. 2000. Some Santa Fe Scenery. In D. Colander (Ed.), *The complexity vision and the teaching of economics*: 29–49. Cheltenham, UK: Edward Elgar.
- Brockhaus, R. H., 1980. "Risk taking propensity of entrepreneurs." *Academy of Management Journal*. 23(3): 509-520.
- Brown, S. L., & Eisenhardt, K. M. 1997. The art of continuous change: Linking complexity theory and time-based evolution in relentlessly shifting organizations. *Administrative Science Quarterly*, 42: 1–34.

- Burgelman, R. A. 1983. A process model of internal corporate venturing in the diversified major firm. *Administrative Science Quarterly*, 28: 223–244.
- Burns, T., & Stalker, G. M. 1961. *The management of innovation*. London: Tavistock.
- Busenitz, L.W., West G.P., Sheperd, D., Nelson, T., Chandler, G.N., & Zacharakis, A. 2003. Entrepreneurship research in emergence: Past trends and future directions. *Journal of Management*, 29: 285-308.
- Bygrave, W. and C. Hofer, 1991. "Theorizing about entrepreneurship." *Entrepreneurship Theory and Practice*. 16(2): 13-23.
- Carter, N., B. Gartner and P. Reynolds, 1996. "Exploring start-up event sequences." *Journal of Business Venturing*. 11: 151-166.
- Casti, J. L. 1994. *Complexification: Explaining a paradoxical world through the science of surprise*. New York: HarperPerennial.
- Cheah, H.-B., 1990. "Schumpeterian and Austrian entrepreneurship: Unity within Duality." *Journal of Business Venturing*. 5: 341-347.
- Cheng, Y. and A. Van de Ven, 1996. "The innovation journey: Order out of chaos?" *Organization Science*. 6: 593-614.
- Chiles, T., Meyer, A., & Hench, T. 2004. Organizational emergence: The origin and transformation of Branson, Missouri's Musical Theaters. *Organization Science*, 15: 499–520.
- Cohen, M., 1999. "Commentary on the Organization Science Special Issue on Complexity." *Organization Science*. 10: 373-376.
- Cooper, A., F. J. Gimeno-Gascon and C. Woo, 1994. "Initial human and financial capital as predictors of new venture performance." *Journal of Business Venturing*. 9: 371-396.
- Covin, J. and Slevin, D., 1991. A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship Theory and Practice*, Fall; 7-25.
- Crutchfield, J., 1994. "Is anything ever new? Considering emergence." in G. Cowan, D. Pines and D. Meltzer, (Ed.), *Complexity: Metaphors, models, and Reality*. Reading, MA, Addison-Wesley.
- Davidsson, P. & Wiklund, J. 2001. Levels of analysis in entrepreneurship research: Current research practice and suggestions for the future. *Entrepreneurship Theory and Practice*, 25(4): 81-100.
- Davis, J., Eisenhardt, K., & Bingham, C. 2007. Developing theory through simulation methods. *Academy of Management Review*, 32: 480-499.

- Delmar, F. & Shane, S. 2004. Legitimizing first: Organizing activities and the survival of new ventures. *Journal of Business Venturing*, 19: 385-411.
- DiMaggio, P. and W. Powell, 1983. "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields." *American Sociological Review*. 48: 147-160.
- Dollinger, M. J., 1995. *Entrepreneurship: Strategies and Resources*. Boston, MA, Irwin.
- Dutton, J. M., & Walton, R. E. 1965. Interdepartmental conflict and cooperation: Two contrasting studies. *Human Organization*, 25: 207-220.
- Dyke, C., 1988. "Cities as dissipative structures." in B. Weber, D. Depew and J. Smith, (Ed.), *Entropy, Enformation and Evolution: New perspectives on physical and biological evolution*. Cambridge, MA, M.I.T. Press.
- Ehrenfeld, J. 2007. Would industrial ecology exist without sustainability in the background? *Journal of Industrial Ecology*, 11: 73-84.
- Eldredge, N., & Gould, S. J. 1972. Punctuated equilibrium: An alternative to phyletic gradualism. In T. J. M. Schopf (Ed.), *Models in paleobiology*: 82-115. San Francisco: Freeman, Cooper.
- Feldman, M. & Pentland, B. 2003. Reconceptualizing organizational routines and a source of flexibility and change. *Administrative Science Quarterly*, 48: 94-118.
- Fisher, R. A. 1930. *The genetical theory of natural selection*. Oxford, UK: Clarendon.
- Fleming, L. and O. Sorenson, 2001. "Technology as a complex adaptive system." *Research Policy*. 30: 1019-1039.
- Fleming, L., & Sorenson, O. 2001. Technology as a complex adaptive system. *Research Policy*, 30: 1019-1039.
- Fuller, Buckminster. 1969. *Operating Manual for Spaceship Earth*. New York, NY: Simon and Schuster.
- Gartner, W., 1985. "A conceptual framework for describing the phenomenon of new venture creation." *Academy of Management Review*. 10: 696-706.
- Gartner, W., 1988. "'Who is an entrepreneur' is the wrong question." *American Journal of Small Business*, 12 (4): 11-32.
- Gartner, W., 1993. "Words lead to deeds: Towards an organizational emergence vocabulary." *Journal of Business Venturing*. : 231-239.
- Gartner, W., B. Bird and J. Starr, 1992. "Acting as if: Differentiating entrepreneurial from organizational behavior." *Entrepreneurship Theory and Practice*. 16(3): 13-30.

- Gartner, W. & Brush, C., 2007. Entrepreneurship as organizing: Emergence, newness and transformation. In T. Habbershon & M. Rice (Eds.), *Praeger Perspectives on Entrepreneurship*, Volume 3, pg. 1-20
- Gartner, W. & Carter, N., 2004. Still trying after all these years: Nascent entrepreneur “semi-survivor” bias in the Panel Study of Entrepreneurial Dynamics. In Gartner (Ed.), *PSED Research Conference I*. Clemson, SC: Clemson University.
- Gartner, W., Shaver, K., Carter, N., & Reynolds, P. (Eds.). 2004. *Handbook of Entrepreneurial Dynamics*. Thousand Oaks, CA: SAGE Publications.
- Gatewood, E., K. Shaver and B. Gartner, 1995. “A longitudinal study of cognitive factors influencing start-up behaviors and success at venture creation.” *Journal of Business Venturing*. 10(5): 371-391.
- Garud, R., Jain, S., & Kumaraswamy, A. 2002. Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java. *Academy of Management Journal*, 45(196-214).
- Garud, R., Kumaraswamy, A., & Sambamurthy, V. 2006. Emergent by design: Performance and transformation at Infosys Technologies. *Organization Science*, 17: 277-286.
- Gavetti, G., & Levinthal, D. A. 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45: 113–137.
- Goldstein, J., 1986. “A far-from-equilibrium systems approach to resistance to change.” *Organizational Dynamics*. 15(1): 5-20.
- Goldstein, J., 1999. “Emergence as a construct: History and Issues.” *Emergence*, 1(1): 49-72.
- Golembiewski, R. T. 1961. Toward the new organization theories: Some notes on “staff.” *Midwest Journal of Political Science*, 5: 237–246.
- Greenwood, R. and C. R. Hinings, 1993. “Understanding strategic change: The contribution of archetypes.” *Academy of Management Journal*. 36: 1052-1081.
- Guastello, S., 1998. "Self-organization in leadership emergence." *Nonlinear Dynamics, Psychology, and Life Science*, 2: 303-316.
- Hills, G. & R. Singh, 2003. “Opportunity Recognition.” In W. Gartner, K. Shaver, N. Carter, & P. Reynolds (Eds.), *Handbook of Entrepreneurial Dynamics*. Thousand Oaks, CA: SAGE.
- Holland, J. H. 1988. The global economy as an adaptive system. In P. W. Anderson & K. J. Arrow, & D. Pines (Eds.), *The economy as an evolving complex system*: 117–124. Reading, MA: Addison-Wesley.
- Holland, J., 1995. *Hidden Order*. Redwood City, CA, Addison-Wesley.

- Homans, G. C. 1950. *The human group*. New York: Harcourt.
- Hunt, C. and H. Aldrich, 1998. "The second ecology: Creation and evolution of organizational communities as exemplified by the commercialization of the World Wide Web." in B. Staw and L. Cummings, (Ed.), *Research in Organizational Behavior*. Greenwich, CT, JAI Press. 20: 267-302.
- Jones, C. 2001. The coevolution of entrepreneurial careers, institutional rules and competitive dynamics in the American film industry, 1985–1920. *Organization Studies*, 6: 911–944.
- Jaworski, J. 1996. *Synchronicity: The Inner Path of Leadership*. San Francisco, CA: Berrett-Koehler.
- Katz, J. and W. Gartner, 1988. "Properties of emerging organizations." *Academy of Management Review*. 13: 429-441.
- Katz, J., 1993. "The dynamics of organizational emergence: A contemporary group formation perspective." *Entrepreneurship Theory and Practice*, (Spring): 97-101.
- Kauffman, S., 1993. *The Origins of Order*. New York, NY, Oxford University Press.
- Kirzner, I. M., 1997. "Entrepreneurial discovery and the competitive market process: An Austrian approach." *Journal of Economic Literature*. 35(1): 60-85.
- Koestler, A., 1979. *Janis-A Summing Up*. New York, Random House.
- Krugman, P., 1996. *The Self-Organizing Economy*. Cambridge, MA, Bradford Press.
- Lant, T. 2000. The rise of Silicon Alley. *Stern Business Review* (Fall/Winter): 10-15.
- Lewes, G. H. 1877. *The physical basis of mind: Being the second series of problems of life and mind*. Boston: J. R. Osgood.
- Lichtenstein, 2000a. "Self-organized transitions: A pattern amid the "chaos" of transformative change." *Academy of Management Executive*. 14(4): 1-14.
- Lichtenstein, B. 2000b. Emergence as a process of self-organizing: New assumptions and insights from the study of nonlinear dynamic systems. *Journal of Organizational Change Management*, 13: 526–544.
- Lichtenstein, B., 2007. "A Matrix of Complexity for Leadership." In J. Hazy; J. Goldstein & B. Lichtenstein (Eds.), *Complex Systems Leadership Theory*. Boston: ISCE Press
- Lichtenstein, B., Carter, N., Dooley, K., & Gartner, W. 2007. Complexity dynamics of nascent entrepreneurship. *Journal of Business Venturing*, 22: 236-261.
- Lichtenstein, B., Dooley, K., & Lumpkin, T. 2006. Measuring emergence in the dynamics of new venture creation. *Journal of Business Venturing*, 21: 153-175

- Lichtenstein, B. & Plowman, D. A. 2007. "The leadership of emergence: A complex systems leadership theory of emergence at successive organizational levels." Paper presented at the Meso-Modeling of Leadership - Festschrift for Prof. Jerry Hunt, Texas Tech University
- Low, M. and E. Abrahamson, 1997. "Movements, bandwagons, and clones: Industry evolution and the entrepreneurial process." *Journal of Business Venturing*. 12: 435-458.
- Low, M. and I. MacMillan, 1988. "Entrepreneurship: Past research and future challenges." *Journal of Management*, 14: 139-162.
- Low, M., 2001. "The adolescence of entrepreneurship research: Specification of purpose." *Entrepreneurship Theory and Practice*. 25(4): 17-26.
- Lumpkin, G. & Dess, G. 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*, 21: 135-172.
- Lumpkin, T. & Lichtenstein, B. 2005. The role of organizational learning in the opportunity recognition process. *Entrepreneurship Theory and Practice*, 29(4): 451-472.
- MacIntosh, R. and D. MacLean, 1999. "Conditioned emergence: A dissipative structures approach to transformation." *Strategic Management Journal*. 20: 297-316.
- Maguire, S., Hardy, C., & Lawrence, T. 2004. Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada. *Academy of Management Journal*, 47: 657-680.
- Mainzer, K. 1994. *Thinking in complexity: The complex dynamics of matter, mind, and mankind*. New York: Springer-Verlag. [4th ed. published in 2004.]
- Malerba, F., R. Nelson, L. Orsenigo and S. Winter, 1999. "'History-friendly' models of industry evolution: The computer industry." *Industrial and Corporate Change*. 8: 3-40.
- Malnight, T. 2001. Emerging structural patterns within multinational corporations: Toward process-based structures. *Academy of Management Journal*, 44: 1187-1210.
- Marion, R., & Uhl-Bien, M. 2001. Leadership in complex organizations. *Leadership Quarterly*, 12: 389-418.
- McKelvey, B. 1997. Quasi-natural organization science. *Organization Science*, 8: 351-381.
- McKelvey, B., 2004. Toward a 0th Law of Thermodynamics: Order creation complexity dynamics from physics and biology to bioeconomics. *Bioeconomics*, 6: 65-96.
- McKelvey, B. & Andriani, P. 2005. Why Gaussian statistics are mostly wrong for strategic organization. *Strategic Organization*, 3: 219-228.
- McKelvey, B. & Lichtenstein, B. 2007. Leadership in the four stages of emergence. In J. Hazy & J. Goldstein & B. Lichtenstein (Eds.), *Complex Systems Leadership Theory*: 93-108. Boston: ISCE Publishing.

- Meyer, G. D. & Heppard, K. A. 2000. Entrepreneurship As Strategy: Competing on the Entrepreneurial Edge. Thousand Oaks, CA: SAGE Publications.
- Mezias, S. and J. Kuperman, 2001. "The community dynamics of entrepreneurship: The birth of the American film industry, 1895-1929." *Journal of Business Venturing*. 16: 209-234.
- Mihata, K., 1997. "The persistence of emergence." in S. H. R. Eve, M. Lee, (Ed.), *Chaos, Complexity, and Sociology*. Thousand Oaks, CA, Sage Publications.
- Miller, J. G., 1978. Living Systems. New York, NY, McGraw-Hill Book Company.
- Morgan, C. L., 1923. *Emergent Evolution*. London, Williams & Norgate.
- Newman, D., 1996. "Emergence and strange attractors." *Philosophy of Science*. 63: 245-261.
- Nicolis, G. and I. Prigogine, 1989. *Exploring Complexity*. New York, NY, W. H. Freeman.
- O'Mahony, S. & Ferraro, F. 2007. The emergence of governance in an open source community. *Academy of Management Journal*, 50: in press.
- Pentland, B. 1992. Organizing moves in software support hot lines. *Administrative Science Quarterly*, 37: 527-549.
- Plowman, D. A., Baker, L., Beck, T., Kulkarni, M., Solankys, S., & Travis, D. 2007. Radical Change Accidentally: The Emergence and Amplification of Small Change. *Academy of Management Journal*, 50: 515-543.
- Popper, S. 1926. Emergence. *Journal of Philosophy*, 23: 241-245.
- Powell, W., Koput, K., & Smith-Doerr, L. 1996. Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, 41: 116-145.
- Prigogine, I. 1955. *An introduction to thermodynamics of irreversible processes*. Springfield, IL: Thomas.
- Rao, H. and J. Singh, 1999. "Types of variation in organizational populations: The speciation of new organizational forms." in J. Baum and B. McKelvey, (Ed.), *Variations in Organization Science*. Thousand Oaks, CA, Sage Publications: 63-78.
- Reuf, M., Aldrich, H., & Carter, N. 2003. The structure of founding teams: Homophily, strong ties and isolation among U.S. entrepreneurs. *American Sociological Review*, 68: 195-225.
- Reynolds, P. and B. Miller, 1992. "New firm gestation: Conception, birth, and implications for research." *Journal of Business Venturing*. 7: 405-471.
- Reynolds, P., 2000. "National panel study of U.S. Business start-ups: Background and methodology." in J. K. R. Brockhaus, (Ed.), *Advances in Entrepreneurship, Firm Emergence, and Growth (Volume 4)*. Stamford, CT, J.A.I. Press, 153-227.

- Rindova, V. & Kotha, S. 2001. Continuous "morphing": Competing through dynamic capabilities, form, and function. *Academy of Management Journal*, 44: 1263-1280.
- Rousseau, D. 1985. Issues of level in organizational research: Multi-level and cross-level perspectives. *Research in Organizational Behavior*, 7: 1-38.
- Roy, D. 1954. Efficiency and "the fix": Informal intergroup relations in a piecework machine shop. *American Journal of Sociology*, 60: 255–266.
- Salthe, S. N. 1993. *Development and evolution: Complexity and change in biology*. Cambridge, MA: Bradford/MIT Press.
- Salthe, S., 1989. "Self-organization of/in hierarchically structured systems." *Systems Research*. 6(3): 199-208.
- Sarasvathy, S., 2000. "Report on the seminar on research perspectives in entrepreneurship." *Journal of Business Venturing*. 15(1-57): .
- Sarasvathy, S., 2001. "Causation and Effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency." *Academy of Management Review*. 26: 243-263.
- Saxenian, A., 1996. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA, Harvard University Press.
- Sayles, L. R. 1957. *Research in industrial human relations*. New York: Harper & Row.
- Schoonhoven, C. B. & Romanelli, E. (Eds.). 2001. *The Entrepreneurship Dynamic*. Stanford, CA: Stanford Business Books.
- Schröder, J., 1998. "Emergence: Non-deducibility or downwards causation?" *Philosophical Quarterly*. 48(193): 433-452.
- Schumpeter, J., 1934/1959. *The Theory of Economic Development*. Boston, MA, Harvard U. Press.
- Selznick, P. 1943. An approach to a theory of bureaucracy. *American Sociological Review*, 8: 47–48.
- Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11: 448–469.
- Shane, S., & Venkataraman, S. 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25: 217–226.
- Siggelkow, N. 2002. Evolution toward fit. *Administrative Science Quarterly*, 47: 125-159.
- Smith, C. 1986. Transformation and regeneration in social systems: A dissipative structure perspective. *Systems Research*, 3: 203-213.

- Sorenson, O. & Audia, P. 2000. The social structure of entrepreneurial activity: Geographic concentration of footwear production in the U.S., 1940-1989. *American Journal of Sociology*, 106: 424-461.
- Sperry, R., 1986. "Discussion: Macro- versus micro-determinism." *Philosophy of Science*. 53: 265-270.
- Spilling, O., 1996. "The entrepreneurial system: On entrepreneurship in the context of a mega-event." *Journal of Business Research*. 36: 91-103.
- Stacey, R. D. 1992. *Managing the unknowable: Strategic boundaries between order and chaos in organizations*. San Francisco, CA: Jossey-Bass.
- Stanley, M., Amaral, L., Buldyrev, S., Havlin, S., Leschhorn, H., Maass, P., Salinger, M., & Stanley, H., 1996. "Scaling behaviour in the growth of companies." *Nature* (letters), 379: 804–806.
- Stephen, A., 1992. "Emergence—A systematic view on its historical facets." in A. Beckermann, H. Flohr and J. Kim, (Ed.), *Emergence or Reduction? Essays on the Prospects of Nonreductive Physicalism*. Berlin, Walter de Gruyter: 25-48.
- Stevenson, H. H. & Harmeling, S. 1990. Entrepreneurial management's need for a more 'chaotic' theory. *Journal of Business Venturing*, 5: 1-14.
- Suarez, F. and Utterback, J.M., 1995. "Dominant designs and the survival of firms." *Strategic Management Journal*, 16: 415-431.
- Torbert, B. a. A. 2004. Action Inquiry: The secret of timely and transforming leadership. San Francisco: Berrett-Koehler.
- Trist, E. L., & Bamforth, K. W. 1951. Social and Psychological Consequences of the Longwall Method of Coal-Getting. *Human Relations*, 4: 3–28.
- Tushman, M. and P. Anderson, 1986. "Technological discontinuities and organizational environments." *Administrative Science Quarterly*. 31: 439-465.
- Ulrich, H. & Probst, J. B. (Eds.). 1984. Self-Organization and Management of Social Systems. Berlin: Springer-Verlag.
- Van de Ven, A. and Engleman, R., 2004. Event- and outcome-driven explanations of entrepreneurship. *Journal of Business Venturing*, 19: 343-358.
- Van de Ven, A. and R. Garud, 1989. "A framework for understanding the emergence of new industries." *Research on Technological Innovation, Management and Policy*, 4: 195-225. JAI Press.
- Van de Ven, A., Pooley, D., Garud, R., & Vankataramen, S. 1999. *The Innovation Journey*. New York, NY: Oxford University Press

- Venkataraman, S., 1997. "The distinctive domain of entrepreneurship research: An editors perspective." in J. Katz and J. Brockhaus, (Ed.), *Advances in Entrepreneurship, Firm Emergence, and Growth*. Greenwich, CT, JAI Press: 119-138.
- von Bertalanffy, L., 1968. *General Systems Theory*. New York, NY, Braziller Books.
- Weber, M. 1924. *Gesammelte Aufsätze zur Sozial- und Wirtschaftsgeschichte*. Tübingen: Mohr (Siebeck). [Republished as *The theory of social and economic organization* (tran. A. H. Henderson & T. Parsons). Glencoe, IL: Free Press, 1947.]
- Webster's, 1996. *Merriam-Webster's Collegiate Dictionary*. Springfield, MA, Merriam-Webster, Inc.
- Weick, K. E. 1977. Organization design: Organizations as self-designing systems. *Organizational Dynamics*, 6: 30–46.
- West, G. B., Brown, J. H., & Enquist, B. J. 1997. A general model for the origin of allometric scaling laws in biology *Science*, 276: 122–126.
- Wilber, K., 1995. *Sex, Ecology, Spirituality*. Boston, MA, Shambhalla Publications.
- Winter, S., 1984. "Schumpeterian competition in alternative technological regimes." *Journal of Economic Behavior and Organization*. 5: 287-320.
- Zipf, G. 1949. *Human behavior and the principle of least effort*. Cambridge, MA: Addison-Wesley.

TABLE 1: The Four Sequences of Dissipative Structures theory, across Multiple Studies

Elements/Sequences → Contexts of emergence:↓	Empirical Study (Data, methods)	1. Dis- Equilibrium Organizing	2. Amplifying Actions	3. Resource Interdependence & (re) Aggregation	4. Stabilizing Feedback
New venture creation. Nascent entrepreneurs founding small companies.	<i>Lichtenstein et al., 2007.</i> Randomized sample of Americans “starting a business,” N=334, three- year PSED data set. Four complexity hypotheses all confirmed, using logit modeling.	1. Adaptive Tension	2. Amplification at threshold	3. Resource interdependence	4. System feedback
Emergence of new configuration. Early stage shifts in business model and goals.	<i>Lichtenstein, 2000.</i> Four young, small, high-growth firms. Weekly tracking of a “major shift” (CEO) in their development over 9-12 months. N=1000 interviews + ~1000 hours of on-site observations.	1. Increased organizing	2. Tension and a threshold	3. Newly Emerging Configuration	4. Outcomes from the transition
Radical Entrepreneurship. Creation of high-growth firm, and transition to IPO	<i>Lichtenstein & Jones 2004.</i> Case analysis of Howard Schultz and Starbucks, Inc. from 1983 to 1995.	1. Adaptive tension, Organizing	2. Stress and Experiments	3. Threshold to Emergent Order	4. Outcomes: Growth, IPO
Organizational Renewal. Knowledge creation in large firms	<i>Nonaka, 1988.</i> Analysis of “intensive case studies” of NEC, NUMMI, TDK, Canon, Honda, Epson, Matsushita, etc.	1. Creation of “Chaos”	2. Amplification of fluctuation	3. New order and Restructuring organizational knowledge	4. Dynamic cooperation to resolve discrepancies
Conditioned Emergence. Corporate transformation	<i>Macintosh & McLean 1999.</i> Two case summaries; Rover Group LLP and a small food manufacturer in Scotland. Planned change method.	1. Far-from- equilibrium conditions	2. Managing positive feedback	3. Conditioning – creating new rules & structure	4. Managing negative feedback

Table 1, continued

	Empirical Study (Data, methods)	1. Dis-Equilibrium Organizing	2. Amplifying Actions	3. Resource Interdependence & (re) Aggregation	4. Stabilizing Feedback
Radical Organizational Change. Emergence of radical change – new identity, mission, and membership	<i>Plowman et al., 2007.</i> Qualitative analysis of 22+ interviews at Mission Church, examining perceptions over 10-years (1985-1995).	1. Far-from-equilibrium conditions	2. Amplifying actions	3. Resource aggregations	4. Negative feedback
Alliance Formation. Emergence of collaborative consortium.	<i>Browning et al., 1995.</i> Qualitative analysis of 60 founding and current executives, + 10 boxes of archival data, and 15 on-site meetings.	1. Irreversible Disequilibrium	2. Self-organizing processes	3. A new order	4. Perception of success = extension of consortium
Regional Agglomeration. Evolution of Branson MO, through successive “punctuated emergences.”	<i>Chiles et al., 2004.</i> Analysis of 38 interviews and extensive archival data, and log-linear, lagged, Poisson regression analysis.	1. Fluctuation dynamics	2. Positive feedback	3. Resource re-combinations	4. Stabilization dynamics

TABLE 2:
LEVELS OF ORGANIZING IN ENTREPRENEURSHIP

Levels of Social Order * <i>From Miller (1978), see Ashmos & Huber, 1988</i>	Elements of Entrepreneurial Organizing	<i>Example of Entrepreneurship Research</i>
Individual	Human Capital	<i>Cooper et al, 1994 Gatewood et al 1995</i>
	Competencies, Skills, Decision to Start	<i>Baron, 2003; Baron & Markman, 2004</i>
Opportunity – Networks⁵	Opportunity Recognition; Creation; Effectuation	<i>Shane and Venkataraman, 2000 Alvarez & Barney 2007; Saras, 2001</i>
	Social (Entrepreneurial) Networks	<i>Aldrich & Kim, 2007</i>
Group and Pre-organization	Team Dynamics	<i>Ruef, Aldrich & Carter, 2003</i>
	Nascent Entrepreneurship Start-up Activities	<i>PSED studies; Delmar & Shane, 2004</i>
Organization	Organization Emergence New Venture Creation	<i>Katz and Gartner, 1988; Lichtenstein et al., 2007</i>
	Corporate Venturing New Entry	<i>Burgelman, 1983; Lumpkin & Dess, 1996</i>
Industry ("Society")**	Industry Creation	<i>Schumpeter, 1934; Van de Ven and Garud, 1989</i>
	Inter-Firm Networks	<i>Powell, Koput, Smith-Doerr, 1996 Aldrich, 1999</i>
Multi-Sector ("Supranational Society")**	Entrepreneurial Region	<i>Spilling, 1986; Saxenian, 1996 Lant, 2000</i>
	Organizational Communities	<i>Hunt and Aldrich, 1998; Chiles, Meyer & Hench, 2004</i>

***Original terms by Miller, 1978, that were also used by Ashmos & Huber, 1988**

⁵ This level (opportunity/networks) is not included in Miller (1978) nor in Ashmos & Huber (1988)

Table 3: Entrepreneurial Action across the Three Degrees of Emergence

Levels of Organizing	1ST–degree Emergence	2ND–degree Emergence	3RD–degree Emergence
Individual	<u>Chaotic Cognition</u> - <i>Finke & Bettle, 1996</i>	<u>Inner Leadership</u> – <i>Jaworski, 1996</i>	<u>Action Inquiry</u> – <i>Torbert, 2004</i>
Opportunity, Networks	<u>Emergent Network Structures</u> – <i>Powell, Kogut & Smith-Doerr, 1996</i>	<u>Opportunity Formation</u> – <i>Shane, 2000; Sarasvathy, 2001</i>	
Pre-Organization, Nascent Organizing	<u>Pattern of Start-up Behaviors</u> – <i>Delmar & Shane, 2004</i>	<u>Leadership emergence in groups</u> – <i>Guastello, 1988</i> <u>Entrepreneurial Teams</u> – <i>Aldrich & Kim, 2007</i>	<u>Leadership of Emergence</u> – <i>Lichtenstein & Plowman, 2007</i>
Organizational Emergence; New Entry	<u>Innovation: Knowledge, New Products</u> <i>Nonaka, 1988; Brown and Eisenhardt, 1997</i>	<u>New Entry</u> – <i>Burgelman, 1983; Lumpkin & Dess, 1996</i> <u>Firm Emergence</u> – <i>Gartner, Bird & Starr, 1992; Katz, 1993; Lichtenstein et al., 2007</i>	<u>Radical Entrepreneurship</u> – <i>Lichtenstein & Jones, 2004</i>
Re-Emergence	<u>Dynamic structuring</u> – <i>Rindova & Kotha, 2001; Feldman & Pentland, 2003</i> <u>Strategic/Organizational Change</u> – <i>Siggelkow, 2002; Baker & Nelson, 2005;</i>	<u>Emergence Events in New Ventures</u> – ; <i>Lichtenstein, Dooley & Lumpkin, 2006</i> <u>Emergent Dynamical Designs</u> – <i>Garud, Kumaraswamy & Sambamurthy, 2006</i>	<u>Organizational Re-Emergence</u> – <i>MacIntosh & MacLean, 1999; Lichtenstein, 2000; Plowman et al., 2007</i>
Industry and Institutional Emergence	<u>Institutional Entrepreneurship</u> – <i>Malnight, 2001; Garud, Jain & Kumaraswamy, 2002; Tushman & Anderson, 1996; O'Mahoney & Farraro, 2007</i>	<u>Emerging Industry / Fields / Forms</u> <i>Van de Ven & Garud, 1989; Jones, 2001; Maguire, Hardy & Lawrence, 2004</i>	<u>Emerging Industry / Fields / Forms</u> <i>Schumpeter, 1934; Low & Abrahamson, 1997; Meyer, Gaba & Colewell, 2005</i>
Emergence of Regions and Communities	<u>Regional Clustering</u> – <i>Krugmann, 1996; Sorenson & Audio, 2000</i>	<u>Regional/Community Emergence</u> – <i>Hunt & Aldrich, 1988; Lant, 2000</i> <u>Industry Symbiosis</u> – <i>Ehrenfeld, 2007</i>	<u>Agglomerations</u> – <i>Chiles, Meyer & Hench, 2005</i>