1-2008

A Scale-Free Theory of Emergence: Four Sequences of Emergence Within, Of, and Across Organizations

Benyamin B. Lichtenstein
University of Massachusetts Boston, b.lichtenstein@umb.edu

A Scale-Free Theory of Emergence:
Four Sequences of Emergence Within, Of, and Across Organizations

Benyamin B. Lichtenstein
University of Massachusetts Boston

Submission to the Organization Science Winter Conference, 2008

UMBCMWP 1038

January 2008

A Scale-Free Theory of Emergence:
Four Sequences of Emergence Within, Of, and Across Organizations

Benyamin B. Lichtenstein
University of Massachusetts, Boston

Submission to the Organization Science Winter Conference, 2008

INTRODUCTION

Emergence – the "coming into being" of new processes, structures and entities – is a consequential phenomenon that management scholars have been exploring since Babbage (1832) described the emergence of a division of labor, and Weber (1947) explained the emergence of bureaucratic hierarchy. Emergence is important and unique not only because it occurs at multiple levels within and across organizations, but also because emergence is the process that *creates* new "levels" of organizing (McKelvey & Lichtenstein, 2007).

Complexity science is particularly well suited for developing a general model of emergence (Holland, 1998; Kauffman, 1993; Nicolis & Prigogine, 1989). Already complexity scholars have explored the dynamics of emergence at multiple levels of organizing (Brown & Eisenhardt, 1997; Chiles, Meyer, & Hench, 2004; Garud, Kumaraswamy, & Sambamurthy, 2006; Levinthal & Warglien, 1999; Watts, 1999) Recently, three major empirical studies have utilized theory-driven insights from complexity to explain the emergence *of* organizations (Lichtenstein, Carter, Dooley, & Gartner, 2007), emergence *within* an organization (Plowman et al., 2007), and emergence *across* organizations (Chiles, Meyer & Hench, 2004). Although these three studies are based on different samples and utilize different analytic methods, nevertheless all three identify and empirically confirm the *same four sequences-conditions* (constructs) which, in combination, appear to generate emergent order in a micro-, meso- and macro-context. These sequences of emergence are (1) dis-equilibrium organizing; (2) amplifying actions; (3) resource interdependence and (re)aggregation, and (4) stabilizing feedback. Table 1 details how closely the four constructs correspond across all three studies.

Please see Table 1: *Four Sequences of Emergence in, of, and across Organizations*

That a single set of system characteristics can produce a phenomenon (emergence) across many orders of magnitude suggests the presence of a "scale-free" theory for emergence (Lewin & McKelvey – Call) . Scale-free research generally identifies one specific process or characteristic that repeats itself across consecutive system levels. However, in contrast to a single "power law" that governs most scale-free phenomena (Boisot & McKelvey, 2007), these three studies of emergence have identified *four sequences* in a process, each of which have been carefully analyzed from contextually rich data that reveals co-evolutionary and behavioral dynamics of emergence at each of these levels. After introducing these four sequences, I will show that these same sequences have been found empirically at virtually every level of management.

SEQUENCES OF EMERGENCE IN MANAGEMENT

(1) Dis-Equilibrium Organizing

Findings from these three studies confirm that emergence is initiated by activities or events which occur outside the norm for each context (Adriani & McKelvey, 2007), creating an "adaptive tension" that pushes the system out of equilibrium – i.e., into a disequilibrium state (McKelvey, 2004). Sustaining this dis-equilibrium mode for an extended period of time seems to be a requisite aspect of emergent order creation (Lichtenstein, 2000; Meyer, Gaba, & Colwell, 2005). For example, Plowman and her colleagues describe a set of dynamic conditions that initiate the "radical emergence" of a new identity at Mission Church; these include a significant decline in membership, an extraordinarily high rate of leadership change, and a new policy of inclusion that differed significantly from the church's highly homogenous past. Together these conditions pushed the church into "far-from-equilibrium dynamics," setting up the emergence process. Similarly, far-from-equilibrium "fluctuation dynamics" initiated the emergence of a collective identity in Branson, MO. These included a dramatic expansion of tourism through two large lakes and a railroad that were built in the region, national publicity of the area through a best-selling book and two "60-Minutes" episodes that highlighted Branson's theatrical explosion, and the arrival of key musical stars like Roy Clark and Andy Williams. These "fluctuations" drove the region farther and farther from equilibrium, creating the conditions for emergence of a collective.

(2) Amplifying Actions

Complexity science shows that when systems are in a dis-equilibrium state, small actions can be amplified through positive feedback and a cycle of self-reinforcement (Anderson, 1999). This process of "deviation amplification" (Maruyama, 1963) creates a dynamic whereby the emergence of one action/event in the system increases the likelihood that other similar events will emerge (Arthur, 1990; Krugman, 1996).

For example, Lichtenstein and his colleagues demonstrate how this "scaffold of emergence" (Holland, 1995) operates in start-up ventures, where the completion of each major organizing activity "provides a catalyst for further activities to be enacted" (Lichtenstein et al., 2007: 244). Their analysis confirmed this process, suggesting that the more a nascent entrepreneur organizes with accelerating momentum, the more likely their business will successfully get up and running. Amplification dynamics were also central to the (re)emergence of Mission Church, which started as an innocuous idea by a few members to provide one Sunday morning meal for homeless people in their neighborhood (Plowman et al., 2007). Given the "silk and stockings" heritage of the membership such an idea would normally have been quickly quashed. But in the context of dis-equilibrium conditions, the spontaneous act – which was neither known nor condoned by the Church's leaders – became amplified into a core driver of radical change.

(3) Resource Interdependence and (re)Aggregation

Complexity scholars have long recognized that emergent behavior only occurs within a regime of interdependence among resources and agents in the system (Kauffman, 1993). Each of these studies confirms the critical role of resource interdependence for initiating self-organizing behavior and for the emergent order that results.

Chiles and his colleagues (2004) show how existing resources were recombined in unexpected ways to support further levels of regional aggregation. For example they show how theater facilities were constantly changing hands, providing easy upgrades for growing theaters and decreased risk for unsuccessful acts. "Theaters never stand empty for long in Branson…If an act folds in midseason…there will be another to take up the lease in a week or two" (Chiles et al., 2004: 513). Lichtenstein and his colleagues use a different approach to resource interdependence that focuses on finding the ideal level (K) of interactions that is strong enough to reach a threshold of order creation but is at the same time below a level that might lead to a "complexity catastrophe," eliminating the possibility of emergence (McKelvey, 1999). The data show that organization emergence was more likely when entrepreneurs developed resources (by completing start-up activities) at a moderate level of concentration – high enough to produce a definite organizing momentum, but low enough that the entrepreneur wasn't stymied by having too much to do all at once.

(4) Stabilizing Feedback

Finally, in all three of these contexts, the new emergent order was stabilized by institutional factors, which helped coordination of activities across the broadening systemic context. For example, negative feedback to the activities at Mission Church helped draw attention to certain gaps or problems in the growing effort, which were then attended to in ways that satisfied a broader range of stakeholders. In a different but comparable way, the emergence of the Branson Mall was usefully kept in check by a strong set of common cultural values, long-standing pro-business policies, and a coordination of marketing efforts through the actions of collective organizations in the area, which "channeled individual action into the well-worn grooves of Branson's value system, helping stabilize each new order" (Chiles et al., 2004: 513).

In summary, each of these three studies uncovers the dynamics of emergence, and each one utilizes virtually the same four constructs (sequences or conditions) to generate a parsimonious explanation of their data. This correspondence is significant partly because the levels of analysis are so different: within an organization vs. the formation of a new firm vs. the agglomeration of an economic ecology, and because the data and analyses are so distinct, ranging from purely qualitative analysis to purely quantitative analysis to a rich combination of both. For these reasons and others, I believe this correspondence points to a rigorous and powerful "scale-free" theory of emergence for management.

EXTENDING THE THEORY ACROSS FURTHER LEVELS

Perhaps it is not coincidental that these four sequences or conditions have been used to explain the emergence of order other management arenas as well. These explanations, which draw on Prigogine's dissipative structures theory (Prigogine & Stengers, 1984) initially appeared in a series of conceptual pieces (e.g. Jantsch, 1980; Leifer, 1989; Smith & Gemmill, 1991). Over the past 10-12 years, however, a series of empirical studies have examined the dynamics of emergence (self-organization) based on these researchers' interpretations of the dissipative structures model. I have found eight independent studies (our three plus five more) across multiple levels of analysis, all of which show the *same four dynamic sequences* underlying

emergence. Table 2 presents each of these studies, including the data and analytic method used and the correspondence of constructs. Next I provide brief descriptions for each study.

Please see Table 2: *Empirical Studies of Emergence Dynamics at Multiple Levels…*

New Venture Creation

This context has already been described as one of the three core empirical works. (1) Adaptive tension within a nascent entrepreneur leads to momentum and (2) Amplification at a threshold. Given the appropriate level of (3) Resource interdependence, a new venture is likely to (4) emerge with system feedback.

Emergence of a New Configuration

Lichtenstein (2000) studied four new and small ventures (less than 7 years old, 30 employees or less) whose founders said they were "on the verge" of a major shift in their development. He tracked this transformation process by interviewing at least half of all employees every week in each firm for 9-12 months, generating 1000 interviews and nearly 1000 hours of on-site observation. Through his analysis he identified a common pattern in the three ventures that made a shift: (1) Increased organizing through a quantifiably higher degree of overall work flow, sparked a concomitant increase in organizational stress – measured as (2) Tension and a Threshold. At a peak of this stress, "a critical event catalyzed a shift" to a (3) Newly Emerging Configuration, which, depending on what he described as the "degree of self-organizing," led to virtuous or disastrous (4) Outcomes which stabilized the system (venture) into a new trajectory of growth or failure.

Radical Entrepreneurship

Using existing secondary sources, Lichtenstein and Jones (2004) developed a case analysis of Starbucks, Inc., examining its origination in 1983 and subsequent transformation by 1995 into a high-potential, high-growth firm. They identified Schultz's (1) Opportunity tension which sparked a flurry of organizing in the company; they showed how that early push led to (2) Stress and Experiments which attempted to relieve that stress; and they identified a "trigger point" of change, described by the CFO: "One day it seemed [that] a critical mass of customers discovered Starbucks… [V]irtually overnight, it just popped." This (3) Order Creation led to (4) outcomes for the firm, including exceptionally high growth and a successful IPO. This internal transformation paralleled and in some ways helped catalyze (co-evolved) the emergence of the specialty coffee market during the same period: "Sales of ready-to-drink coffee skyrocketed, rising almost 3000% in the early 1990s" (Koehn, 2001: 16).

Organizational Renewal

Nonaka's (1998) model of self-organization in self-renewing Japanese firms identifies four "conditions" in a "dynamic process which will trigger fluctuation, amplify it, and produce dynamic cooperation to resolve the inconsistencies" (Nonaka, 1988: 61). Thus, (1) Creation of Chaos, which includes "creating challenging but equivocal vision" and "generating a fluctuation" leads to (2) Amplification of a Fluctuation. (3) The New Order and Restructuring Organizational

Knowledge is a key result which is managed (stabilized) through (4) a Dynamic Cooperative process for Resolving Discrepancies.

Conditioned Emergence
A second example of emergent transformation in corporate settings was developed by Macintosh & McLean (1999) based on their action-inquiry analysis of two large-scale change efforts. Both interventions of "conditioned emergence" were sparked by creating (1) Far-from-equilibrium conditions, and having managers (2) apply Positive Feedback to "small signals" for change. This "provides the multiplier effect which causes the nonlinear development of new systems" (page 306). At the same time there is a process of (3) Conditioning the organization by highlighting the rules and deep structure which underpins its current practices. Finally, "through the repeated application of the deep structure rules," the new attractor is stabilized, another aspect of (4) Managing the feedback process.

Radical Organizational Change
We described this context above as well. An accidental yet radical emergence at Mission Church was shown to be caused by four conditions: (1) Far-from-equilibrium conditions, (2) Amplifying actions; (3) Resource aggregations, and (4) Negative Feedback.

Alliance Formation
Browning, Beyer and Shetler (1995) describe how the collaborative SEMATECH consortium emerged and flourished over a 7-year period, thus playing an important role in maintaining U.S. dominance in the semiconductor industry. In their discussion of qualitative results, they showed how the process could be explained in terms of four elements: (1) an Irreversible disequilibrium which initiates the process, (2) Self-organizing processes that created flexible opportunity structures that members could build on, (3) and A new order – effectively "a new organization form… that would facilitate cooperation." This led to (4) a perception of success that extended (doubled) the lifetime of what was designed as a temporary collaboration. That these four elements are so clearly described is highly supportive of the theory, given that the "complexity literature" they were drawing from (e.g. Jantsch, 1982; Leifer, 1989; Smith & Gemmill, 1991) is based on insights which had not really been applied in a management context.

Regional Agglomeration
Here is the third context which we described above. (1) Fluctuation dynamics and (2) Positive feedback leads to (3) resource re-combinations that tend to occur in "punctuated emergences" over time. Each of these newly emergent "eras" is maintained through (4) Stabilization dynamics within the overall ecology.

IMPLICATIONS

In summary, my analysis has identified a strong correspondence between the four constructs researchers have used to explain emergence dynamics at these multiple levels/stages of organizing:

- New Venture Emergence (creation of a firm)
- Early Organizational Development (emergence of new business models in new ventures)
- Transformations in large firms (emergence, renewal, transformations in 'stable' organizations)

- Multiple organizations (alliance formation)
- Geographic regions (regional agglomeration and co-evolution)

Several implications stand out. From a research perspective, this study strongly supports the efforts to identify and explore specific scale-free theories in management. At the same time, these constructs go far beyond single equations, instead providing rich and in-depth explanations of the conditions, sequences and dynamics of emergence at all these levels. This approach can solve some of the limitations of complexity simulations (Lichtenstein et al., 2007b), while at the same time providing a broad framework for further research.

In that regard, this four-sequence theory provides specific hypotheses to test on the organizing levels that have not yet been included. Specifically, the emergence of small groups has not yet been empirically studied using this four-fold framework, although Smith & Gemmill (1991) used these four constructs in their empirical description of "self-organization" in small groups. Likewise, it is intriguing to speculate that personal transformation (e.g. the emergence of new cognitive states) might follow the same four sequences.

Further, as interest in emergence continues to grow, it is possible that this four-fold model might help explain the dynamics underlying emergence in other arenas, including for example:

- Social network formation (e.g. Wagner & Leydesdorff, 2005)
- Emergence of leaders in small groups (e.g. Guastello, 1998)
- Leadership of emergence in organizations (e.g. Marion, Uhl-Bein & McKelvey, 2007)
- Emergent organizing structures (e.g. Garud et al., 2006)
- Emergence of new dominant designs (e.g. Garud, Jain, & Kumaraswamy, 2002)
- Emergence of industries (e.g. Garud & Karnøe, 2003)
- Industry symbiosis (e.g. Ehrenfeld, 2007)

and so on.

This approach is also highly relevant to managers seeking to generate conditions for emergence within their organizations. That is, the depth of these constructs and their development from lived experience (primarily interviews and observations) makes it possible to present detailed behavioral interpretations of each one, leading to tangible suggestions for what leaders at all levels can do to promote these conditions (e.g. Lichtenstein & Plowman, 2007). A good deal of further testing will further define and clarify the appropriate actions.

Finally, this entire approach exemplifies a kind of "evidence-based" theorizing, which focuses much more on the relevance and application of managerial ideas rather than on an abstract and objective formulation. My hope is that I am contributing to the positive movement toward relevance in management research, a movement that can and perhaps should be led by complexity science.

REFERENCES

Adriani, P., & McKelvey, B. 2007. Beyond Gaussian averages: Redirecting organization science toward extreme events and power laws. ***Journal of International Business Studies***, 38((Nov-Dec)).

Anderson, P. 1999. Complexity theory and organization science. ***Organization Science***, 10: 216-232.

Arthur, B. 1990. Positive feedbacks in the economy. ***Scientific American***, February: 92-99.

Babbage, C. 1932. ***On the economy of machinery and manufactures.*** London: Knight.

Boisot, M., & McKelvey, B. 2007. Extreme events, power laws, and adaptation: Towards an econphysics of organization. ***Academy of Management Conference Best Papers Proceedings***, OMT.

Brown, S., & Eisenhardt, K. 1997. The art of continuous change: Linking complexity theory and time-based evolution in relentlessly shifting organizations. ***Administrative Science Quarterly***, 42: 1-34.

Browning, L., Beyer, J., & Shetler, J. 1995. Building cooperation in a competitive industry: Sematech and the semiconductor industry. ***Academy of Management Journal***, 38: 113-151.

Chiles, T., Meyer, A., & Hench, T. 2004. Organizational emergence: The origin and transformation of Branson, Missouri's Musical Theaters. ***Organization Science***, 15(5): 499-520.

Ehrenfeld, J. 2007. Would industrial ecology exist without sustainability in the background? ***Journal of Industrial Ecology***, 11: 73-84.

Eigen, M., & Schuster, P. 1979. ***The Hypercycle***. Berlin: Springer-Verlag.

Garud, R., Jain, S., & Kumaraswamy, A. 2002. Institutional entrepreneurship in the sponsorship of comon technological standards: The case of Sun Microsystems adn Java. ***Academy of Management Journal***, 45(196-214).

Garud, R., & Karnøe, P. 2003. Bricolage versus breakthrough: distributed and embedded agency in technology entrepreneurship. ***Research Policy***, 32: 277-301.

Garud, R., Kumaraswamy, A., & Sambamurthy, V. 2006. Emergent by design: Performance and transformation at Infosys Technologies. ***Organization Science***, 17: 277-286.

Guastello, S. 1998. Self-organization and leadership emergence. ***Nonlinear Dynamics, Psychology, and Life Sciences***, 2: 301-315.

Holland, J. 1995. ***Hidden Order***. Redwood City, CA: Addison-Wesley.

Holland, J. 1998. ***Emergence: From Chaos to Order***. Cambridge, MA: Perseus Books.

Jantsch, E. 1980. ***The Self-Organizing Universe***. New York, NY: Pergamon Press.

Kauffman, S. 1993. ***The Origins of Order***. New York, NY: Oxford University Press.

Koehn, N., 2001. ***Howard Schultz and Starbucks coffee company.*** Boston, MA, Harvard Business School.

Krugman, P. 1996. ***The Self-Organizing Economy***. Cambridge, MA: Bradford Press.

Leifer, R. 1989. Understanding organizational transformation using a dissipative structure model. ***Human Relations***, 42: 899-916.

Levinthal, D., & Warglien, M. 1999. Landscape Deisgn: Designing for local action in complex worlds. ***Organization Science***, 10(3): 342-357.

Lichtenstein, B. 2000. Self-organized transitions: A pattern amid the "chaos" of transformative change. ***Academy of Management Executive***, 14(4): 128-141.

Lichtenstein, B., Allen, P., Anderson, P., McKelvey, B., & Rivkin, J. 2007b. "Toward a Theory of Complexity for Management." *Showcase Symposium, presented at the Academy of Management Annual Meeting. 2007; Philadelphia, PA.*

Lichtenstein, B., Carter, N., Dooley, K., & Gartner, W. 2007. Complexity dynamics of nascent entrepreneurship. ***Journal of Business Venturing***, 22: 236-261.

Lichtenstein, B., & Jones, C. 2004. A self-organization theory of radical entrepreneurship. ***Best Papers Proceedings, National Academy of Management***: OMT Division; CD format.

Lichtenstein, B. & Plowman, D.A., 2007. "The Leadership of emergence: A complex systems leadership theory of emergence at successive organizational levels." Presented at the "Meso-Modeling in Leadership" conference, Texas Tech University, Oct. 10, 2007

MacIntosh, R., & MacLean, D. 1999. Conditioned emergence: A dissipative structures approach to transformation. ***Strategic Management Journal***, 20: 297-316.

Maruyama, M. 1963. The second cybernetics. ***American Scientist***, 51: 164-179.

McKelvey, B. 1999. Avoiding complexity catastrophe in coevolutionary pockets: Strategies for rugged landscapes. ***Organization Science***, 10(3): 294-321.

McKelvey, B. 2004. Toward a complexity science of entrepreneurship. ***Journal of Business Venturing***, 19: 313-342.

McKelvey, B. & Lichtenstein, B., 2007. "Leadership in the Four Stages of Emergence." In J. Hazy, J. Goldstein, & B. Lichtenstein (Eds.), Complex Systems Leadership 'Theory. Boston, MA: ISCE Press.

Meyer, A., Gaba, V., & Colwell, K. 2005. Organizing far from equilibrium: Nonlinear change in organizational fields. ***Organization Science***, 16(456-473).

Nicolis, G., & Prigogine, I. 1989. ***Exploring Complexity***. New York, NY: W. H. Freeman.

Nonaka, I. 1988. Creating organizational order out of chaos: Self-renewal in Japanese firms. ***California Management Review***, Spring: 57-73.

Plowman, D. A., Baker, L., Beck, T., Kulkarni, M., Solanksy, S., & Travis, D. 2007. Radical Change Accidentally: The Emergence and Amplification of Small Change. ***Academy of Management Journal***, 50: 515-543.

Prigogine, I., & Stengers, I. 1984. ***Order out of Chaos***. New York, NY: Bantam Books.

Smith, C., & Gemmill, G. 1991. Self-Organization in small groups: A study of group effectivenss within non-equilibrium conditions. ***Human Relations***, 44: 697-716.

Wagner, C. & Leydesdorff, L., 2005. Network structure, self-organization, and the growth of international collaboration in science. ***Research Policy,*** 34: 1608-1618.

Watts, D. 1999. Networks, Dynamics, and the Small-World Phenomenon. ***American Journal of Sociology***, 105: 493-527.

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.]

Table 1: Four Conditions of Emergence *in, of,* and *across* Organizations

	Plowman, Baker, Beck, Kulkarni, Solansky & Travis, 2007	**Lichtenstein, Carter, Dooley & Gartner, 2007**	**Chiles, Meyer & Hench, 2004**
Theoretical focus	Emergence IN one organization: radical and continuous change	Emergence OF new organizations: new venture creation	Emergence ACROSS Organizations: creation of organizational collective
'Unit' of interest	Single organization (Mission Church)	Random sample (N=335) of nascent entrepreneurs	Organizational collective (Branson, MO)
Longitudinal data	10 years: 1975 – 2005	3 years: 1996 – 1999	100 years: 1895 – 1995
Methodology	Qualitative, grounded theory development	Quantitative, logit-model tests of theory-driven hypotheses	Narrative, grounded case analysis, and Poisson regression - foundings analysis.
Conditions of Emergence Empirical connection of constructs:	1. Far-From-Equilibrium Conditions	1. Adaptive Tension: Far-from-equilibrium organizing	1. Fluctuation Dynamics
	2. Amplifying Actions	2. Amplification at a Threshold	2. Positive Feedback
	3. Resource Aggregations	3. Resource Interdependence at the "edge of chaos"	3. Resource Re-combinations
	4. Negative Feedback	4. System Feedback – Outcomes	4. Stabilization Dynamics

System Conditions that support a Leadership of Emergence **(An integration of the above studies)**

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

Table 2: Empirical Studies of Emergence Dynamics at Multiple Levels of Organizing and Organization – each shares virtually the same four "conditions" or elements (constructs) in their analysis:

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

Table 2, continued

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