Levels and degrees of emergence: toward a matrix of complexity in entrepreneurship

Benyamin Lichtenstein, University of Massachusetts Boston
Levels and degrees of emergence: toward a matrix of complexity in entrepreneurship

Benyamin B. Lichtenstein

Department of Management and Marketing, University of Massachusetts, Boston, MA 02115, USA
E-mail: Benyamin.bml@gmail.com

Abstract: Emergence is at the core of entrepreneurship research, which has explored the coming-into-being of opportunities, new organisations, re-organisations, and new industries, agglomerations, and so on. Emergence is also at the theoretical core of complexity science, which is dedicated to exploring how and why emergence happens in dynamic systems like entrepreneurship. I propose a definition for emergence, which leads to the notion that emergence can occur in ‘degrees’ – from 1st-degree emergence to 2nd-degree and 3rd-degree emergence. Next, I provide a complexity-based explanation for the driver of emergence – ‘opportunity tension’, which sparks the entrepreneuring process. Finally, I draw from recent analyses of emergence to identify a process-theory of order creation, and show how this is driven or sparked by entrepreneuring. This leads to a matrix of emergence in entrepreneurship, which captures the degrees of emergence across the levels of entrepreneurial organising.

Keywords: entrepreneurship; emergence; dynamic; systems; levels of analysis; opportunity; theory; entrepreneuring; start-up; complexity science.


Biographical notes: Benyamin B. Lichtenstein is an Associate Professor of Management and Entrepreneurship at the University of Massachusetts, Boston. He has been studying complexity science for over 30 years; his research has led to a theory of emergence that he has applied in more than 40 papers – many in internationally acclaimed journals, and two books on complexity and leadership. He is the Research Director for the Entrepreneurship Center at U-Mass Boston and a Research Fellow for the Center for Sustainable Enterprise.

1 Introduction

Emergence – the creation of new systemic structure and order – has become increasingly important in organisation science and in entrepreneurship. Management scholars have shown the centrality of emergence at all levels of organising, e.g., in individual and entrepreneurial decision-making (Minniti, 2004; Sarasvathy, 2001); leadership (Plowman et al., 2007b; Uhl-Bien et al., 2007); teams (Guastello, 1998); organisational design
(Brown and Eisenhardt, 1997; Garud et al., 2006); and processes of organisational adaptation and strategic change (Gavetti and Levinthal, 2000; MacIntosh and MacLean, 1999; Sonenshein, 2009). At more macro levels, emergence has been used to explain the creation of new institutional practices (Lounsbury and Crumley, 2007), governance processes in alliances (O’Mahony and Ferraro, 2007), the enactment of new industry standards (Garud et al., 2002), the creation of new industry forms (Perretti et al., 2008), the emergence of new markets (Sarasvathy and Dew, 2005) and the generation of new institutional fields (e.g., Jones, 2001; Maguire et al., 2004) and agglomerations (Chiles et al., 2004).

Entrepreneurship scholars have long explored issues of emergence, as evidenced by Bygrave’s (1989) link between deterministic chaos and new venture creation, and Gartner’s (1993) vocabulary of organisational emergence. More recently, emergence has become central to our understanding of entrepreneurial opportunities and how they are: enacted (Aldrich and Kenworthy, 1999), created (Alvarez and Barney, 2007), co-created (Chiasson and Saunders, 2005) and dynamically created (Chiles et al., 2010), through cycles of formulation, testing, and re-formulation (Sarasvathy, 2001). Capitalising on entrepreneurial opportunities requires the emergence of organisations; a framework for organisational emergence was first presented by Katz and Gartner (1988); the existence of the four hypothesised ‘properties of emerging organisations’ was recently confirmed in an empirical test on nascent entrepreneurs (Brush et al., 2008). Specific qualities of emergence have been shown to distinguish successful start-ups from unsuccessful ones (Lichtenstein et al., 2007), and these dynamics appear to positively influence longer-term success as well (Davidsson, 2006; Slevin and Covin, 1997). Finally, a growing series of studies show how, during the start-up and early growth of new ventures, entire business models emerge and re-emerge, generating new product platforms (Baker and Nelson, 2005), new strategic goals and structures (Lichtenstein, 2000), and/or a new perceived mission and organising strategy (Lichtenstein et al., 2006).

Given the importance of emergence to organisation science generally and entrepreneurship specifically, it is surprising that a formal definition of emergence has not yet appeared in the literature, nor have scholars proposed a model for understanding and explaining how and when social phenomenon, like new organisations, do in fact ‘emerge’ [Alvarez and Parker, (2009), p.223]. 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 (McKelvey, 2004).

This paper offers a definition for emergence in management, and responds to some key questions about emergence, including: what triggers emergent phenomena? Is all emergence the same? How is emergence related to ‘levels of analysis’ in organisations? I begin by providing an integrated driver for the emergence of new order: ‘opportunity tension’. I then show how opportunity tension can lead to different ‘degrees’ of emergence – a kind of continuum of emergent outcomes, each with progressively more novelty and influence. These three degrees of emergence also reveal an unexpected distinction between emergence in time (diachronic emergence) and emergence in space (synchronic emergence); by combining these two categories of emergence, a far more complete set of ‘levels’ in organisation science is made explicit. Finally, since the creation of each of these levels (in space and in time) is generated through an entrepreneurial process, my overall claim is that entrepreneurship explores a much broader range of phenomena than is commonly thought.
Levels and degrees of emergence

2  The driver of emergence: opportunity tension

Perhaps the most well-studied context of emergence in entrepreneurship is the creation and start-up of new firms – organisational emergence (Katz and Gartner, 1988; Gartner, 1993). Researchers have explored two key aspects of this context, including the dynamics of nascent entrepreneurship [see Davidsson (2006) for a complete summary of these findings], and the nature of entrepreneurial opportunity, which many have argued to be the key driver of new venture creation (Shane and Venkataraman, 2000). Given the increasing role of ‘opportunity’ in entrepreneurship research, this is a useful place to ask: what is it that drives organisational emergence?

2.1 Opportunity alone does not spark organisational emergence

A good deal of progress has been made in exploring the nature of entrepreneurial opportunity from a rigorous academic perspective (McMullen et al., 2007). At the same time, a central dichotomy exists in the literature, between opportunities as recognised vs. created: Is economic opportunity an objective phenomena that is recognisable by anyone with the right information (Kirzner, 1997; Shane, 2000), or is opportunity fundamentally a creative phenomenon which gets enacted by an entrepreneur through her/his interactions in a context (Sarasvathy, 2001; Chiasson and Saunders, 2005; Chiles et al., 2010)? As I will suggest below, researchers have been heading toward a ‘both-and’ resolution to this issue (Alvarez and Barney, 2007).

However, there is a fundamental problem with focusing on opportunities per se, as a driver of new venture creation (Shane and Venkataraman, 2000). If in theory entrepreneurship is about opportunity, then in practice entrepreneurs should be focused around the discovery and exploitation of opportunity. As such, we could empirically 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, the goal that animates their pursuit of entrepreneurship, is to capitalise on an opportunity they have identified in the environment.

Such an empirical test is feasible, and in fact has already been accomplished. The panel study of entrepreneurial dynamics (PSED – see Gartner et al., 2004b) is a random sample of over 1,000 nascent entrepreneurs starting businesses in the USA. One question in the survey asked individuals to identify the driver of their business activity, whether it was the business idea – an opportunity – or their decision to start any business: ‘Which came first for you, the business idea or your decision to start some kind of business?’.

The answers to this question were surprising: Nearly two-thirds of all respondents said that rather than opportunity per se, it was a ‘decision to start’ a business that was primary or simultaneous to identifying a particular opportunity. In a surprising disproof of the primacy-of-opportunity approach, only 36.9% replied that the opportunity alone came first [Hills and Singh, (2003), p.266].

These findings strongly suggest that opportunity per se may not be the primary locus or driver of entrepreneurial behaviour. This leads to a theoretical gap: What is the driver of entrepreneurial activity? Is it ‘in’ the entrepreneur? Is it ‘in’ the environment? How does it operate?
2.2 ‘Opportunity tension’ and the entrepreneuring process

One solution to this question is the construct ‘opportunity tension’, a complexity-inspired framework derived from McKelvey’s (2004) drivers of order creation. McKelvey argues that the catalyst of entrepreneurship is an ‘adaptive tension’ between the entrepreneur and the environment. The tension is adaptive in that it can generate order, but the tension inherently seeks resolution. [See Fritz (1989) for a parallel in creativity research.] Adaptive tension is the result of an ‘energy differential’ – a discernable difference between existing resources within the entrepreneur, and a potential new pool of energy/resources that the entrepreneur wants to access. This differential between the aspiration of the entrepreneur and the opportunity they hope to capitalise on, generates a pressure to act: In a literal sense the energy differential puts the entrepreneur and his/her venture into a disequilibrium state. As we know from the 2nd law of thermodynamics, a disequilibrium always seeks to be resolved or dissipated (Prigogine and Glansdorff, 1971; Prigogine and Stengers, 1984). Thus, it is the disequilibrium that activates entrepreneurial behaviour – the dynamic tension between a perceived opportunity and the intention to enact it, whether through starting a venture, transforming a company, or creating value in a novel way.

Thus, opportunity tension represents an internal drive – the entrepreneur’s intention, which arises with his/her perception and co-creation of a business opportunity (Alvarez and Barney, 2007). Opportunity tension is initiated when an entrepreneur identifies and begins to develop a business opportunity, i.e., the energy potential that defines a niche/market, and simultaneous constructs a way to capitalise on that economic potential through a unique and sustainable business model (Zott and Amit, 2007).

Once identified, enacting an opportunity takes a huge amount of time, commitment and effort – a great deal of intention and action. Empirical evidence shows that the greater this drive to action the more likely that a business will actually emerge as an independent start-up venture (Lichtenstein et al., 2007). Opportunity tension is generated through great personal passion (Adler and Obstfeld, 2007) – a ‘creative tension’ within the entrepreneur (Fritz, 1989; Senge, 2006) that leads to capitalising on the opportunity. As McKelvey (2001, p.195) confirms, this tension is sparked by the energy differential and by a motivation to act on it: “Energy differentials need to have a motivational valance attached before they can be expected to be felt as tension by agents”. This motivational valence is opportunity tension: it’s the felt belief that the opportunity is viable and worth pursuing. This internal opportunity tension effectively pushes an entrepreneur to organise a business. In this way, opportunity tension describes the dual drivers of entrepreneurial order-creation.

Important to this perspective is that this urgency, this push, does not last forever. The internal tension that drives action does not exist indefinitely, nor is it ‘stabilising’. Like the source of creative tension in artists (Fritz, 1989), adaptive tension motivates and drives action for an intense period of time, sometimes generating a kind of ‘flow’ state (Csikszentmihalyi, 1990). Within this flow state organising continues until the initial goal is achieved (Lichtenstein et al., 2007), or the goal itself may shift through the organising process (Sarasvathy, 2001). Opportunity tension is thus a pulse of activity – a committed intention to pursue this project and generate an emergent result. If everything works (…!) a new business will emerge: New order will come into being that literally converts the market potential into real value to be received by a target market; they pay for that value using new resources that keep the organisational operating.
Levels and degrees of emergence

In the best of these self-organising ventures, the firms themselves are often organised as highly innovative ‘novelty-centred’ businesses (Zott and Amit, 2007) that incentivise all employees to support and produce an ongoing stream of adaptive tensions. An increasing amount of research is describing the results of this generative approach to organising, starting with Brown and Eisenhardt’s (1997) analysis of ‘self-organising in project groups’, and now including Garud and his colleagues’ examination of emerging structures and institutions (Garud et al., 2002, 2006), Feldman’s (2000) exposition on routines for change, Rindova and Kotha’s (2001) description of ‘continuous morphing’ and so on. In this view, Zott and Amit’s (2007) insightful construct of ‘novelty-centred businesses’ supports the idea that ‘far-from-equilibrium’ conditions represent a culture or business model of high-energy, innovation-based organising. This state is highly dynamic, and yet it can generate and regenerate itself for long periods of time. Opportunity Tension leads to the onset of entrepreneuring, i.e., ‘entrepreneurship as a verb’ [Steyaert, (2007), p.453]. When entrepreneuring becomes realised, one outcome is the emergence of something new. Emergence thus provides a specific framework for explaining and tracking entrepreneurial outcomes (Brush and Vanderwerf, 1992). These outcomes are sometimes the creation of new firms, or new products within firm, but include a wide range of possibilities. In order to appreciate this range of outcomes, we next turn to an in-depth analysis into the nature of emergence itself. This analysis will lead to a definition of emergence for management while revealing subtleties in the phenomenon which will help extend our understanding of emergence within and between organisations.

3 Three degrees of emergence

3.1 Defining emergence

For over 100 years, the question of ‘what is emergence’ has intrigued philosophers (Lewes, 1877; Popper, 1926; Stephen, 1992), evolutionists (Eldredge and Gould, 1972; Fisher, 1930; Kauffman, 1993; Morgan, 1923), complexity scientists (Crutchfield, 1994; Holland, 1988; Nicolis and Prigogine, 1989); and a wide range of management scholars (Goldstein, 1986; McKelvey, 1997; Weick, 1977). 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, (1997), p.30].

Over time, as scholars have attempted to ‘characterise that which has so emerged’, most of those characterisations have revolved around the notion of ‘qualitative novelty’. Qualitative novelty refers to the coming into being of a qualitatively new level of order that is unexpected or novel in some way. For example, evolutionary emergentists use ‘qualitative novelty’ to describe the emergence of new ‘levels’ of physical or biological reality (Blitz, 1992). In Newman’s (1996, p.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.” In this definition, ‘level of evolutionary…complexity’ refers to the emergence of distinct levels of analysis, which is
the approach mostly common in management. However, Mihata (1997, p.31) expands this definition in his summary 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.

These definitions highlight an important distinction that expands the scope of emergence. For Mihata, emergence includes the creation of a ‘new level’ of social reality, e.g., the emergence of a team, the emergence of an organisation, and so on. At the same time, emergence also refers to ‘patterns or global-level structures’ that are created in dynamic systems. These patterns may occur within a specific level of analysis rather than leading to the creation of a new level. For example, in the studies of emergence based on Kauffman’s NK landscapes model (Ganco and Agarwal, 2009; Gavetti and Levinthal, 2000), what emerges is a network structure of interaction within the system. The presence of this network is correlated with outcomes: the greater the emergence of structural patterns (up to a point), the more adaptive the system overall.

This expanded notion of emergence is reflected in Goldstein’s (1999, p.49) parsimonious definition, which is most useful for management and entrepreneurship: “Emergence…refers to the arising of novel and coherent structures, patterns, and properties in…complex systems.” Drawing on the flexibility of this definition, Lichtenstein et al. (2006) define an ‘emergence event’ in a nascent venture as a system-wide shift that transforms the venture but does not result in a new level of analysis: “An emergence event is a coordinated and punctuated shift in multiple modes of entrepreneurial organising 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 what emerges are new properties and characteristics that significantly affect the next phases of nascent organising.

In a general sense, these definitions and examples suggest that the process of emergence may result in one of several types of outcomes. Specifically, the strongest outcomes of emergence would be the creation of a new ‘level of reality’ as defined by systems scientists (Miller, 1978). Less strong outcomes would be the creation of new properties within a specific level, or causal ‘laws’ that are identified across levels. In other words, the emergence of patterns or internal structuring reflects a somewhat weaker form of emergence than the kind of whole-system emergence that generates an entirely new epoch or level of reality.

Following this line of thinking, I build on Goldstein’s (1999) definition by arguing that there are a continuum of emergence outcomes that reflect three degrees of emergence. At the lower end of the continuum, 1st-degree ORDER emergence represents novel properties which come into being through system-wide interactions. 2nd-degree SYSTEMIC emergence reflects the coming-into-being of a distinct ‘level of analysis’ of the system – a kind of ‘new system level’ (Miller, 1978; Ashmos and Huber, 1987). Finally, in 3rd-degree RADICAL emergence properties are created in the new level which ‘supervene on’ – i.e., influence or govern – the behaviour and relationships of the component agents from that point forward. The following four sub-sections review each of these degrees – see Figure 1.
Figure 1 Three degrees of emergence

![Diagram showing three degrees of emergence: 1st degree (Order emergence), 2nd degree (Systemic emergence), and 3rd degree (Radical emergence (with supervenience)).](image)

Source: Adapted from Lichtenstein and Kurjanowicz (2010)

3.2 First-degree ORDER emergence: agent interactions that lead to internal order

The first degree of emergence is a persistent pattern or structure within a dynamic system. In this case the unit of analysis – the system – remains constant; what emerges is some kind of internal ordering which remains relatively stable over time. This emergent structure is often measured or modelled post hoc, from outside the system, as the system and its participants (agents) may be unaware that something has actually emerged (Crutchfield, 1994). Although these emergent patterns do influence the system (hopefully for the better!), they do not in and of themselves constitute a distinct level of order or unit of analysis. Instead, 1st-degree emergence generates a potential new pathway for organising which can lead to different outcomes over time. However, the emergent order does not have the qualities of an interdependent agent; thus, it cannot become the foundation for a distinct level of order.

1st-degree emergence is exemplified by the pattern of innovation identified by Fleming and Sorenson (2001) in their NK-based analysis of patent data. They found that the most successful inventions were created, i.e., emerged, through the integration of a large number of components (modules) with a moderate degree of interdependence. Here, what emerges is an internal pattern – in this case, a pattern of interaction that is used to distinguish outcomes of innovation. The pattern, which can be distinguished through hundreds of iterations of the model, represents an internal and post hoc order that is not, in and of itself, a distinct level of organising. Most NK studies exemplify 1st-degree emergence. For example, Ganco and Agarawal (2009) show how entrepreneurial firms generate internal structures based on their strategic choices.

Another example of 1st-degree emergence is the formation of ‘semi-structures’ that were found in the most successful new product development teams (Brown and Eisenhardt, 1997). These were described as patterns of organising, configurations of
activity and communication which emerged (or did not) in response to the dynamic environment for innovation in the firm. A similar referent is the ‘self-organisation’ of structures in high-growth entrepreneurial companies (Nicholls-Nixon, 2005), which appear to improve performance without generating a distinct level or unit of organising in the firm.

3.3 Power laws as 1st-degree emergence

A stronger version of 1st-degree emergence occurs when a single process, rule, or algorithm generates a ‘macro-pattern’ of order across many scales (Casti, 1994), leading to a ‘power law’. A power law is a mathematical description of dynamics that are invariant across many orders of magnitude (Andriani and McKelvey, 2007). In common parlance, when the log-log distribution of two system dimensions is a straight line – as Zipf (1949) found for the rank vs. size of all US cities – the emergent outcomes is a ‘power law’ which reflects some process that is invariant across scales. As Andriani and McKelvey (2007) describe,

If plotted on double-log paper, Pareto distributions show the distinctive ‘power law’ signature – a negatively sloping straight line. Power laws seem ubiquitous…They apply to earthquakes, web hits, phone calls, wealth…cities, and firms. Power law phenomena call for ‘scale-free theories’ because the same cause and explanation apply to each of the different levels. They exhibit the power law signature because they shrink by a fixed ratio.

Their paper identifies more than 80 power-law phenomena, many of which being social processes.

An exemplar of power law emergence is the study by Stanley et al. (1996), who examined the relationship between growth rate and internal structuring of manufacturing firms in the USA. They found that one specific ratio – a single scaling law – explained that relationship across seven orders of magnitude, i.e., from companies with as few as ten employees to firms with more than 100,000. In biology, West et al. (1997) demonstrate a power law relationship between the mass and metabolism of virtually any organism and its components – across 27 orders of magnitude (of mass).

These power laws are more pervasive than 1st-degree emergence; however, they still occur within one ‘level of analysis’, rather than across more than one level. That is: the emergent phenomena that Stanley et al. found pertains to structuring in manufacturing firms. Here, the firm is the unit of analysis, the level of reality, under investigation. Even though the same pattern was found across many contiguous scales – seven orders of magnitude – the power law relationship stays within the firm. The study neither examines nor finds a corresponding relationship between structures within work teams, or structures of manufacturing alliances, or patterns of relationships across industries. Thus it represents a stronger type of 1st-degree emergence, a type that is critical for to understanding dynamic systems. In particular, Brock (2000, p.30) suggested that power laws are the key contribution of complexity science; observing that the study of complexity “…tries to understand the forces that underlie the patterns or scaling laws that develop as newly ordered systems emerge.”
3.4 Second-degree SYSTEMIC 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, higher-level system that is qualitatively different from the components which make it up (Crutchfield, 1994). More than the emergence of properties 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). In traditional systems language, this more extensive level of analysis transcends the previous level, yet includes that level as an ‘agent’ or sub-system (Koestler, 1979).

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 behaviours that are intended to make the organisation ‘known’ to its environment (Gartner et al., 1992; Sarasvathy, 2001). At some point in the process of organising, 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 (Brush et al., 2008). Emergence here reflects the creation of a new level of order – the interdependent components have become a firm (Katz and Gartner, 1988). 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 behaviours, 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 et al. (1992, pp.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.

Studies of 2nd-degree emergence are well represented in entrepreneurship research. For example, Shane (2000) and others show how distinct business opportunities are developed and enacted over time. In a similar way, researchers (e.g., Lichtenstein et al., 2007) have examined the dynamic patterns of nascent entrepreneurial organising which lead to the creation of new independent firms; in corporate settings, a series of classic studies have explained how ‘new entry’ is enacted and defined (Burgelman, 1983; Lumpkin and Dess, 1996). Other examples include the emergence and re-emergence of formal organising structures (Garud et al., 2006), the emergence of new institutional fields (Jones, 2001), and the emergence of new communities (Hunt and Aldrich, 1998).

Note that the outcome of entrepreneuring in these examples is the emergence of a distinct unit of analysis; nascent entrepreneurs, for example, develop their venture out of a series of ‘organising behaviours’ (Gartner et al., 2004); the ‘up-and-running’ organisation is literally the result of these behaviours, and yet the tangible existence of that organisation is defined by whole-system properties which transcend these behaviours (Lichtenstein et al., 2007). Similarly, Jones (2001) shows how the early movie industry
was developed through the individual and collective actions of inventive entrepreneurs; at the same time the defining characteristics of the industry transcended even its most visible protagonists and promoters. In these ways, the presence of this new level does not appear to cause tangible changes to the components themselves. For example, neither Burgelman nor Lumpkin and Dess present any evidence that the emergence of the new entity leads to material changes in its champions nor in the components of the product or its design. Similarly, the emergence of a distinct organisational community does not necessarily alter the operations of the companies within it (Hunt and Aldrich, 1988), just as the emergence of a symbiotic relationship between local firms does not appear to cause significant shifts in the behaviours of member companies (Ehrenfeld, 2007). In contrast, this is precisely the distinguishing characteristic in 3rd-degree emergence.

3.5 Third degree RADICAL emergence: creation of a new level with supervenience

The third and strongest form of emergence adds the critical property of supervenience, i.e., the emergent entity as a whole exerts a felt influence on its components. Embedded in this idea is the concept of ‘downward causation’, referring to higher-level processes that causally influence their lower level constituents (Blitz, 1992). Sperry’s (1986, p.267) theory of ‘macro-determinism’ expresses this idea by showing how the ‘parts’ or constituents of a system become ‘governed’ by the newly emergent properties of the higher-level system:

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

The notion of supervenience 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.

An example of supervenience is documented by Plowman et al. (2007a) in their study of radical emergence at ‘Mission Church’. Sparked by an informal brainstorm from a non-member, the one-time initiative to feed local homeless people became the catalyst for dramatic changes within the church and within the initiative itself. In particular, the success of the first Sunday breakfast sparked an unexpected enthusiasm amongst its organisers that led to a year-long series of self-organised and self-funded events, and as the visibility of the initiative grew its leaders altered their tactics and modes of organising, focusing first on resource acquisition (e.g., creating new space, gaining volunteers with specific expertise) and later on broader efforts to institutionalise the effort. Moreover, the attitude and behaviours of the church leaders also transformed as the initially innocuous project soon became the focal point for a dramatic shift in the meaning and mission of the entire organisation. Likewise, the behaviours and decisions of the community and its pastors were strongly influenced by the growing legitimacy and publicity of the initiative, leading to even more radical moves by the leaders, significant shifts in church membership, and changes in the way the community related to the church as a whole. As one might expect, emergent outcomes (e.g., the creation of the initiative; the re-formulation of the Church’s mission around the initiative) and their impact on agent behaviours (e.g., the internal development of the organising committee; dramatic
Levels and degrees of emergence

public actions by the pastors) were interdependent and co-evolving, creating an accelerating feedback loop which strengthened both the system and its components.

Another example of 3rd-degree of emergence can be shown in some studies of industry creation, through which a new population comes into being as a distinct unit of order, and that new order generates sociological and/or institutional properties which constrain and govern the behaviour of its component firms. For example, Aldrich (1999, Chapter 9) has suggested how the strategies facilitating industry emergence can impact organisational-level processes of learning and legitimacy. Separately, Low and Abrahamson (1997) show how an emerging firm’s organising 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, 1988) and the dynamics of density-dependence (Carroll, 1988) become salient. The co-evolutionary creation of a new industry illustrates the third degree of emergence.

4 Levels of analysis in entrepreneurship

In order to figure out what emerges and how, it will be useful to distinguish the contexts from which emergence happens. Broadly, these contexts or arenas can be categorised in terms of ‘levels of analysis’, so we begin by reviewing what are the levels of analysis in management and in entrepreneurship. The importance of identifying ‘levels of analysis’ has been well expressed by management scholars (Rousseau, 1985), and the urgent need to incorporate more than one level of analysis in entrepreneurship studies has been argued strongly for some years (e.g., Davidsson and Wiklund, 2001). However, there is a paucity of theory-driven explanation for distinguishing a set of nested levels (except see Ashmos and Huber, 1987), and virtually no one has explained how these levels themselves emerge. Doing so, which is my goal here, will provide a useful framework for explaining emergence in management.

Systems theory, which itself is at the origin of the field of management (Katz and Kahn, 1966; Scott, 1981; Thompson, 1967) provides a theory for understanding the distinct levels of social reality (Boulding, 1988; Fuller, 1969; von Bertalanffy, 1968). Specifically, these scholars defined a system as a set of interdependent, interacting components – now termed ‘agents’ (Axelrod and Cohen, 2000; Holland, 1995) where each agent is itself composed of ‘lower level’ agents, and so on, in a nested series of hierarchical levels that presumably begins with subatomic particles. Moving ‘upward’ through these levels of physical and social reality, atoms are systemic ‘agents’ that aggregate to molecules; molecules are systemic agents that aggregate to cells; cells aggregate to organs, and so on. Put another way: the interdependent interaction of cells-as-agents leads to the emergence of organs; through the interdependence of organ systems there emerges an organism; the interdependent interactions of individual organisms can generate the emergence of a group; and so on again.

As the scope and range of these agent interactions was more carefully specified, these researchers identified core principles of agents and of systems which were invariant across multiple scales of reality. The culmination of this work was the remarkable 1,100+ page text by Miller (1978), who identified nineteen principles or ‘subsystems’ that were invariant across seven scales of living systems. These scales or levels were
operationalised as the cell, the organ, the organism, the group, the organisation, the society, and the supranational system. In addition, Miller organised these principles into 173 distinct hypotheses for a ‘general theory of living systems’. Figure 2 presents this generalised living system, and the ‘shred out’ of this system into seven empirically distinct levels.

**Figure 2**  Miller’s 19 subsystems across seven distinct system levels

In organisation studies, these principles were distilled into nine properties (Katz and Kahn, 1966, in Ashmos and Huber, 1987), and over time these levels of organising were differentially explored by the fields of organisational behaviour (micro-levels of individuals and groups), organisation studies (meso-level of organisation), and organisational sociology (macro-level of institution and society). Research in entrepreneurship is almost always limited to one particular level; Davidsson and Wiklund (2001) found that less than 20% of the studies they analysed spanned more than one level. They also complained (2001, p.84) that “…rather ‘conventional’ levels of analysis totally dominate the picture” and this domination is evident in their simplistic categorisation of entrepreneurship research into ‘micro’ levels including the individual and the firm, and ‘aggregate’ levels that include the industry and the region.

However, the arenas of entrepreneurship research are far more wide-spread than this picture suggests. For example, entrepreneurial networks have been the subject of a large set of studies (e.g., Aldrich and Kim, 2007; Hoang and Antoncic, 2003), and Shane (2000) was instrumental in identifying ‘opportunity’ as a distinct unit of analysis. As mentioned above, the literature on entrepreneurial firms is not unitary, but incorporates research on the entire process of organisational birth, development, and strategic change – i.e., from the dynamic creation (Chiles et al., 2007) and re-creation of opportunity (Sarasvathy, 2001), to nascent entrepreneurship and the creation of new firms (Davidsson, 2006), to the re-emergence and transformation of small and new companies (Garnsey et al., 2006; Nicholls-Nixon, 2005), to the presence and development of entrepreneurship in large organisations (Lumpkin and Dess, 1996), and finally to the emerging field of strategic entrepreneurship (Schendel and Hitt, 2007). In addition to the role of innovation in sparking new ventures (Van de Ven et al., 1999), entrepreneurial
Levels and degrees of emergence

research has explored the emergence of alliances and collaborations, regions and agglomerations (Chiles et al., 2004), and the re-formation of entire economies (Tan, 2007). Can we find a single theoretical framework to organise this breadth of study?

4.1 Distinguishing organisation (in space) and organising (over time)

One approach for developing a comprehensive set of ‘levels’ in entrepreneurship is to distinguish ‘synchronic’ versus ‘diachronic’ system levels. The synchronic view focuses on the formal system levels (Miller, 1978) of individual, team, organisation, society, etc., whereas the diachronic view focuses on an emerging set of organisational states – the organising processes that generate a series of increasingly complex and ordered states over time. These ‘dynamic states’ (Levie and Lichtenstein, 2010) of ‘dynamic creation’ (Chiles et al., 2010) have been empirically identified in terms of stages of development (Greiner, 1972; Low and MacMillan, 1988), organisational ‘epochs’ (Cheng and Van de Ven, 1996; Dooley and Van de Ven, 1999), and as steps in the process of organisational emergence (Gartner, 1993). Primarily these dynamic states or entrepreneurial epochs include:

1. the formation of an opportunity
2. the process of nascent organising and start-up
3. organisational emergence and new entry
4. the re-emergence or transformation of new organisations
5. the dynamics of larger organisations.

All of these diachronic states exist within the synchronic level of organisation; thus ‘the organisation’, which appears to be a unitary level in the synchronic view, is seen in the diachronic view as an unfolding process that reflects a series of dynamic states. Each dynamic state transcends its predecessor while fully including the previous components (agents). Further, each ‘dynamic state’ is a new context within which the agents continue to organise, just as each ‘higher’ synchronic level is a new context for agent organising. Complexity studies have shown how agent interactions in dynamic states can lead to the emergence of a new level of order that can be distinguished and measured in organisational terms (e.g., Lichtenstein et al., 2006, 2007). This set of synchronic levels and diachronic states are presented in Figure 3.

This distinction between synchronic and diachronic levels is similar to the distinction between explanations of entrepreneurship that are outcome driven versus process-based. The former (Van de Ven and Engleman, 2004) focuses on the nested system levels that represents a stable outcome of agent interactions, whereas the latter focus on the dynamics of organising which accrue through a series of punctuations (Katz, 1993), ‘emergence events’ (Lichtenstein et al., 2006), or punctuated dis-equilibrium (Chiles et al., 2010). Synchronic view moves from individual to team to organisation, a diachronic analysis recognises the entrepreneurial network as level of organising that links individuals and generates opportunities, just as opportunities reflect the nexus of individuals and networks (Sarasson et al., 2006). Likewise, an aggregation of firms starts with one collaboration, and extends to others, over time, in progressive ‘eras’ of emergence (Chiles et al., 2004). By combining both approaches, we gain a much broader palate of organising ‘levels’ that are described by entrepreneurship.
With this background we can turn to our first question: What is emergence? Does it represent a singular outcome? Are there more subtle aspects to emergence in entrepreneurship?

4.2 Toward a matrix of emergence

By now it may be clear that each of these levels or arenas of organising are created through an emergence process. In other words, the distinct levels of analysis – whether synchronic (Davidsson and Wiklund, 2001) or diachronic (Gartner, 1993) – do not exist a priori; instead they are always created, and this creation is always a unique event. In a corresponding way, these emergences are not unitary; we have identified at least three types or degrees of emergence which can originate within each of the levels of entrepreneurial reality. This logic leads to a kind of matrix – shown in Figure 3 – whereby within each level of analysis all three degrees of emergence can be presented.

Figure 3  Levels of analysis and states of organising in entrepreneurship

This ‘matrix of complexity’ – presented in Table 1 – identifies at least one empirical study that exemplifies how each of the degrees of emergence is expressed within each of the levels of analysis. For example, the classic research by Powell et al. (1996) shows the 1st-degree emergence of knowledge networks; Shane’s (2000) exemplary study shows how one specific technology can lead to the 2nd-degree emergence of distinct entrepreneurial opportunities; Aldrich and Kim (2007) study the 2nd-degree emergence of entrepreneurial teams; Lichtenstein et al. (2007) analyse the 3rd-degree emergence of nascent ventures, and so on. My overall argument, presented in more detail below, is that the entire range of emergences across this entire range of levels defines the scope of entrepreneuring. From a process-oriented perspective, this range – from 1st-degree emergence of individual cognition to 3rd-degree emergence of regional agglomerations – should be the scope of entrepreneuring.
### Table 1: A matrix of complexity in entrepreneurship

<table>
<thead>
<tr>
<th>Levels of organising</th>
<th>1st-degree order emergence</th>
<th>2nd-degree systemic emergence</th>
<th>3rd-degree radical emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Team composition patterns (Aldrich and Kim 2007)</td>
<td>Team emergence (Katz, 1993)</td>
<td></td>
</tr>
<tr>
<td>Chaotic cognition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-organisation, nascent organising</td>
<td>Emergent network structures (Powell et al., 1996)</td>
<td>Opportunity formation (Shane, 2000; Alvarez and Barney, 2007)</td>
<td>Opportunity creation (Sarasvathy, 2001; Chiles et al., 2010)</td>
</tr>
<tr>
<td>Patterns of start-up behaviours (Delmar and Shane, 2004)</td>
<td>Leadership emergence in groups (Gaastello, 2007)</td>
<td>Leadership of emergence (Lichtenstein and Plowman, 2009)</td>
<td></td>
</tr>
<tr>
<td>Re-emergence</td>
<td>Dynamic structuring (Rindova and Kotha, 2001; Feldman and Pentland, 2003)</td>
<td>Emergence events in new ventures (Lichtenstein et al., 2006)</td>
<td>Organisational re-emergence (MacIntosh and MacLean, 1999; Lichtenstein, 2000; Plowman et al., 2007a)</td>
</tr>
<tr>
<td>Strategic/organisational change (Siggalokw, 2002; Baker and Nelson, 2005)</td>
<td>Emergent dynamical designs (Garud et al., 2006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry and institutional emergence</td>
<td>Institutional entrepreneurship (Malnight, 2001; Garud et al., 2002; O’Mahony and Ferraro, 2007)</td>
<td>Emerging industry/fields/forms (Jones, 2001)</td>
<td>Emerging industry/fields/forms (Low and Abrahamson, 1997; Maguire et al., 2004)</td>
</tr>
<tr>
<td>Co-evolution (e.g., Lewin et al., 1999)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergence of regions and communities</td>
<td>Regional clustering (Krugman, 1996; Sorenson and Audio, 2000)</td>
<td>Regional/community emergence (Hunt and Aldrich, 1998; Lant, 2000)</td>
<td>Agglomerations (Chiles et al., 2004)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industry symbiosis (Ehrenfeld, 2007)</td>
<td></td>
</tr>
</tbody>
</table>
5 Implications and conclusions

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. After reviewing the important role of emergence in entrepreneurship, I drew from philosophers and complexity scholars to develop a formal definition of emergence. This led to a recognition that emergence occurs in successive degrees: from 1st-degree emergence of internal structures, to power-law dynamics, to 2nd-degree emergence of a new entity, through the 3rd-degree emergence of a new system level that supervenes on its subordinate agents. Next, I argued that the driver of social emergence is entrepreneuring – a behavioural response to high levels of opportunity tension – a catalyst that leads entrepreneurs into a dis-equilibrium state. In all, complexity science offers a distinct definition of emergence, and a well-confirmed process-theory of emergence, whose driver is opportunity tension and entrepreneuring.

Several implications are readily apparent. First, this complexity approach offers an expanded view of entrepreneurship, by arguing that each of the phenomena described in Table 1 are initiated by the entrepreneuring process. That is, although the set of activities listed in Table 1 cover virtually every discipline in management, the complexity framework identifies an underlying similarity: all are catalysed, originated, set into motion, by the driver of entrepreneuring, i.e., opportunity tension. By viewing entrepreneurship as emergence, the field can become a central contributor to many contexts, including individual creativity and opportunity formation, emergent networks, leadership, group development, new entry, nascent organising, emergent design, strategy creation, institutional entrepreneuring, field emergence, agglomerations, and more. The driver of them all is entrepreneuring – an expression of opportunity tension that generates enterprising behaviour in the entrepreneur-group-venture-institution-society.

In other words, the claim I’m making is that entrepreneurship is not a subset of strategy, not a derivative of economics, and not a specialisation of management. These disciplines all assume the existence of an organisation – virtually all of economics and management is the study of how extant firms (and their environments) change and develop over time. But emergence is not about change: Emergence is the creation of something new, the instantiation of a unique and boundaried entity that did not exist before it emerged (Gartner, 1993). Once this entity comes into being, the stage is set for understanding the unfoldment of its evolutionary development and change. In exactly the same way, entrepreneuring is the driver of social creation, the catalyst of all unique and boundaried entities that we experience and operate within throughout our social world.

As such, entrepreneuring as a discipline underlies the fabric of organisation science. Entrepreneurship is the study of emergence – the emergence of new ideas, new technology, new networks, new ventures, new organisations, new initiatives, new entry, new alliances, new fields, new industries, new agglomerations. That process of coming into being is – should be – the purvue of entrepreneurial scholarship, and can be greatly assisted by complexity science. Once one of these levels or entities have come into being, the further study of change and expansion is best accomplished by more mainstream theories and methods well known in other management disciplines such as organisational behaviour, strategy, innovation management, finance, operations, economics, and so on.

Complexity science itself may offers a unique approach for the study of entrepreneurship. If entrepreneuring is indeed at the core of these many disparate phenomena, perhaps complexity can support an integration that would lead to better
knowledge and practice in these arenas, as well as place entrepreneurship more centrally within the disciplines of management.

These very strong views and my argument in general must be balanced by many limitations. First, this framework represents only one of many ways to apply complexity to management. In comparison, for example, McKelvey’s (2004) application emphasised the role of simulations and computational modelling for enhancing entrepreneurial theory. Likewise, early complexity frameworks from Bygrave (1989), Cheng and Van de Ven (1996), and others use different approaches including deterministic chaos theory and more metaphorical explanations of non-linear dynamics. Scholars have identified 16 different schools of complexity science (see Goldstein, 1999; McKelvey, 2004), this paper primarily draws from the dissipative structures theory, and thus should be seen as only one potential application of complexity. At the same time, my 25-year study of complexity has led me to the belief that dissipative structures provides the most rigorous and applicable theory of order emergence, especially in entrepreneurial settings.

In addition, my framing of entrepreneurship, my definitions of emergence, and the invention of ‘opportunity tension’ are necessarily limited. Others would assess these fields in much more complete ways, and a variety of arguments could be made against each of my claims. Although I have worked hard to integrate these many levels of entrepreneurial activity, I can only hope that my many gaps in knowledge will be partially filled by my readers in your comments to this paper.

To the degree these limitations can be mitigated or taken into account, I see great value in linking entrepreneurship to complexity science. Through continuing advances in methodological sophistication and organisational application of complexity, these frameworks offer new insights into the emergence of structure and pattern in dynamic interactive systems (Stevenson and Harmeling, 1990; McKelvey, 2004). If carefully operationalised and harnessed, complexity science may provide an elegant structure on which to build and empirically test comprehensive theories of entrepreneurial emergence.

References


Levels and degrees of emergence


Levels and degrees of emergence


