

The landscape of management: Creating the context for understanding social complexity

David Snowden and Peter Stanbridge

Cynefin Center for Organizational Complexity, UK
Korora Limited, UK

This report and opinion piece seeks to establish a model in which complexity can be positioned in the context of other management disciplines, in such a way as to effectively communicate to executives in industry and their equivalents in government the importance of applying complexity thinking. It also seeks to differentiate what is termed 'social complexity' from 'mathematical complexity' in the context of the development of management science. The background to this paper is taken from the findings in a recently completed study for the European Commission entitled "Business Needs and Technology Trends in Knowledge Management" (the Study). The purpose of the Study was to answer questions concerning the role of, and future research requirements for, knowledge management (KM) that would enlarge an understanding of how knowledge management should contribute to the Lisbon Objectives of Europe becoming a global leader in the knowledge economy. In effect, the study aimed to see how KM should contribute toward growing the competitiveness of European businesses.

A critical conclusion of the study was that social complexity provided a key strategic advantage of a diverse multi-cultural economic unit such as Europe (and by implication Asia and Africa) in the emergent knowledge economy, and that imitation of the research agenda and focus of the current dominant economic player, the USA, would in consequence be a mistake. In effect an approach to intellectual capital that arose in the context of infinitely available resources^[1], and the creation of a common and new cultural identity based on the exploitation of those resources, is not an appropriate approach for the knowledge economy per se. This paper expands briefly and speculatively on some of the implications of this conclusion.

It is no coincidence that a report on the role of knowledge management should give rise to a means of understanding the landscape of management theory into which complexity thinking is entering. Knowledge management, unlike Business Process

Re-engineering which preceded it as a focus of management attention, was one of the first management disciplines that attempted to deal with complexities of human knowledge and its transmission in other than a fairly structured and explicit context. It is also one of the few management fads of the last few decades that can not be traced to a single author, arising and maintaining itself from a broad and divergent range of sources. The inherent uncertainty and ambiguity of human acts of knowing lends itself to complexity based thinking.

In the Study, we developed a model that would penetrate the underlying intellectual perspectives adopted by the various schools of knowledge management. It became clear to us quite early on in the study that some organizing scheme was necessary to try to make sense of the multitude of approaches to knowledge management advocated by academics and practitioners alike. In doing so, we noticed the overlap in thinking between knowledge management researchers and business strategists, which is not surprising given the strategic importance of knowledge and information in businesses today. We also found that commentators on strategy present a perplexingly large number of different schools (such as Mintzberg, *et al.*, 1998, who identify ten different schools of strategy) which provide little help when trying to gauge the effectiveness and appropriateness of different approaches to organizational competitiveness. In a word, schools of thought within knowledge management and organizational strategy can be multiplied ad-infinitum, but the underlying philosophical perspectives remain relatively stable.

In effect a model originally created to understand the portfolio of knowledge management research projects in the European Community rapidly evolved into a means to make sense of the place of complexity in the wider context of management theory.

Before we present that model, we make a few preliminary remarks about the goal of knowledge management, the relevancy for SMEs, approaches adopted by large corporate organizations and typical approaches to management consultancy practice. The purpose of this paper is to report on the model. Readers wishing

more data on the knowledge management aspects of the Study and the supporting material on existing European Community funded research projects should download the paper from www.cynefin.net which also contains other papers on both the strategic aspects of complexity and the specific application of complexity thinking to knowledge management.

We will then present the model which has proved powerful in allowing management to understand the role that complexity thinking provides in the context of the various management theory that they already know and practice. In producing this model we were concerned to separate thinking about human systems from that of 'nature' and this distinguished between mathematical and social complexity. We were also concerned (with Griffin, 2002; Stacy, 2001; and others) to clearly separate complex systems thinking from that of the majority of systems thinking, and which differentiates human or social complexity from mathematical complexity.

Finally some implications of the model and some anecdotal material relating to its usefulness will conclude the paper.

Knowledge management

A particularly intriguing characteristic of knowledge management is that it has not faded as a serious management concern despite its shortcomings as a discipline in failing to provide organizations with all it has promised. Another characteristic of knowledge management is the diversity of approaches and technologies that became associated with it alongside its evolution.

On the one hand, the strategic importance of the subject area of knowledge management is widely acknowledged - given, for example, the growing demand for innovation and the increasing knowledge-intensity of many business areas. However, the connection with concrete management practices or technologies is still fuzzy.

For some time the concern for knowledge management has been carried by the hype-wave of the virtual or networked organization in the context of electronic business. However, it has not necessarily benefited from this connection. Neither has it benefited from being regarded as a technology-centric discipline. The Study perceives knowledge management as neither a tool nor a trend. Instead, in its core it relates directly to a fundamental and fascinating discipline of organizational behavior: the building and learning of organizational capabilities and the mechanisms by which these capabilities are stored and transferred into organizational action.

The Study claims that part of the confusion and frustration associated with the knowledge management domain is linked to this overgeneralization of approaches and missing understanding of the diverse theoretical backgrounds that have led to them. In the context of practical application, it pays out negatively that knowledge management is one of the most multifaceted areas in management theory.

The Study puts forward the proposition that innovation and enhanced decision making are the two primary business drivers being addressed by knowledge management and much organizational strategy today. There are many and well documented reasons for this, some of which are:

- The globalized nature of business;
- Transformation from a product to service-based economy;
- Increased complexity involved in developing and deploying products and services;
- Changing demographics, leading to concerns about knowledge loss.

But the primary concern has been shifts in the global economy. Robert Grant (2000) provides a summary from his survey of knowledge management literature:

- The new primary factor of production in the new economy is knowledge, as opposed to that of labor, machinery and monetary capital in the industrial economy;
- The concentration of intangibles over tangibles. Service and not goods is the predominant value driver. Primary assets are therefore intangibles, such as technology, brands over land, buildings and machinery;
- It is networked. Current communications technologies enable vast networks of people and machines, enhanced by the digitization of data. This vastly expands the possibilities of coordinated action and collaboration within and outside the organization, region, country and industry;
- It is digital. Digitization of data brings enormous possibilities and capacity for transferring, storing and processing of information;
- It is virtual in nature; the growing role of virtual money, virtual transactions, virtual communities, are dissolving the boundaries between the real and the imaginary;
- It is fast moving. The economy is subject to rapid change. This is primarily the result of the rapid pace of innovation and also the impact of new communications technology. We have seen this in the

huge reduction in product life-cycles.

The Study sums up by noticing the following trends in the literature:

- Dissolving boundaries between firms and markets through e-Business;
- Growing role of collaborative organizational forms and the increasing realization that small and medium sized enterprises (SMEs) are key to innovation and economic growth;
- Tendency for disintermediation;
- Growth in globalization resulting from trade liberalization and multinational organizations and the advent of the knowledge economy (knowledge has no boundaries);
- A blurring of the produce/consumer distinction (with, e.g., configurable products, interactive media etc.).

We find similar accounts in other literature on knowledge management. See for example, Choo and Bontis (2002), Blackler (2002), Drucker (1993), Boisot (2002), Grant (2002), Krogh and Grand (2002), Garud and Kumaraswamy (2002), Barabba, *et al.* (2002), Sveiby (1997), Kumar (1995), and Borghoff and Preschi (1998) who state in their introduction that knowledge is becoming increasingly relevant for organizations since the “shift from an industrial economy based on assembly lines and hierarchical control to a global, decentralized, information-driven economy.” The current organizational climate is described as a ‘global village’, where decision making is participatory and decentralized. We are now entering an age of ‘Knowledge-Work’.

However not all writers agree on some or all of these explanations, and even Grant (2002: 31) has issued challenges. But our main apprehension is that we notice an endorsement within certain strands of knowledge management for an ‘economics of knowledge packaging’ [2] which is an extension of Taylorism and scientific management. It is far removed from a democratization and personalization of work power. It is instead a centralization and standardization of ever higher levels of management and knowledge intensive work. This view is corroborated by Kumar (1995: 19), who, quoting various writers, has shown that much service work is as ‘Taylorized’ as work in manufacturing industries and that the information society is essentially the further application of Taylorism.

The implications of this are clear. Apart from the potentially negative impact on the citizen and furthering disempowerment of SMEs, there is a real danger that knowledge management, which is sup-

posed to create a more agile and innovative (and hence competitive) organizations will in fact trigger the opposite. Knowledge management is in danger of backfiring as a result of an approach to knowledge management that amounts to large corporate militancy. This will also leave SMEs in a subservient relationship with powerful corporate players dominating supply-chain productivity to breaking point [3].

A large proportion of European businesses are SMEs. SMEs in Europe are faced with competing in the new global markets, but they are not traditionally geared toward a global perspective. While SMEs in Europe have a long tradition of understanding multiculturalism, they have not traditionally been required to work competitively or collaboratively, on a global scale [4]. Knowledge management and the implications of intellectual capital must work for SMEs in Europe. The SME market cannot be excluded from the knowledge management program, but neither should they be enforced into adopting knowledge management approaches that have been designed for the larger corporate entities.

Management fads and the importance of theory

Management fads are a part of the landscape of both business and government and it could be argued that a succession of fads in effect provides novelty and new perspective. Rather like a bush fire which clears the ground for new growth, each new wave sweeps unchecked through industry and as it starts to fail gains a second wave of energy as government adopt ‘industrial best practice’. The nature of the fad itself may not be as important as the fact that it allows us to concentrate on some hitherto neglected aspect of our organization. However many of these ‘fads’ are often over simplistic recipes put together in haste without thought or awareness of theory. There is also a strong tendency to claim universality for each new fad, driven by the business needs of consultancy firms and technology providers who evidence an almost evangelical zeal in their claims for the benefits of adopting the latest approach. In this they have been assisted by an strong anti-intellectual tradition in management which seeks simplistic approaches based on clear and idealistic outcomes.

Aspects of this fad culture have been challenged recently in a well constructed article by Christensen and Raynor (2003). It argues that executives need to pay more attention to management theory rather than paying attention to simple recipes derived from a superficial understanding of past practice in other organizations “in the naïve belief that if a particular course of action helped other companies to succeed, it ought to help theirs too.” The article states that good

theory should be part of a three stage process which commences with the observation and description of phenomenon we wish to explore which are then sorted into categories from which a theory is formulated. The process is then cyclical as the theory is used to predict future observations, with the theory being refined or refuted based on the results of those observations.

While we agree with Christensen and Raynor's diagnostic of the dangers of 'simple recipes' it does not follow that their theory of theories has to be accepted as stated. The study of phenomenon and the derivation of hypothesis assume by its nature the pre-existence of some form of causality which can be identified. We will argue later that one of the insights of social complexity is the ability of human systems to shape their perception of the world and thus to 'co-evolve' concept and practice to create a new reality; a fact that has contributed accidentally to the reported success of many a management fad. The excellence of their article lies in its identification of the dangers of using a limited amount of data to construct general theories, the way in which correlations are used to masquerade as causation, and the frequent use of partial selections of data from the same organizations to prove contradictory theories. Hopefully this article will encourage executives to avoid simple recipes or better still discourage them from the all to frequent anti-theory approach in which 'academic' is considered a term of abuse.

As stated earlier, while there is a massive diversity of both theory and recipe in the field of management science and practice there are, we contend, some underlying theoretical assumptions, biases or bases that allow us to construct a model through which we can create some coherence to the babble of competing 'universalisms'.

Model dimensions

The form of the model is one of the ubiquitous two by two matrixes (Figure 1) that abound in management theory. Indeed the authors are forced to the conclusion that a compulsive desire to reduce complex issues such a matrix steps from some world wide conspiracy to infect incoming management students with a virus on entering management school! By way of excuse and apology the authors offer the excuse of having to write for an audience accustomed to working and using such matrices, and more importantly that on this occasion it seems to make sense.

The vertical axis makes a distinction between ordered and unordered system, and this distinction is seen as a defector absolute boundary. The horizontal axis represents a spectrum from low ambiguity interventions represented as 'rules' to high ambiguity represented as 'heuristics'. In effect the matrix works

in the vertical with *ontology*[5], the nature of things defined in terms of causality, and in the horizontal with *epistemology*, the nature of knowledge defined in terms of action.

Order and unordered

Order is used here in the sense of a system in which the relationships between cause and effect can be discovered, and which repeat given the same starting situations. The nature of order can be 'visible' or self-evident, or it can be hidden, requiring investigation, analysis and frequently the application of expert interpretation. Such systems can be highly complicated, but the relationships between cause and effect remain both discoverable and capable of forming a basis of mandating and predicting action. Management science has been dominated by the concept of order - in effect it is based on a single-ontology approach to sense making that can be traced back to Taylor and scientific management at the start of the last century. Taylor himself drew on a nineteenth century concept of science that had originated in the enlightenment predicated on the belief that the reason for all things could be discovered given sufficient time and scientific endeavor.

However the last few decades have resulted in a new understanding of systems in which causality is anything but stable, and while relationship may be coherent in retrospect, they do not form a basis for action or prediction. Unorder here is used to encompass both complexity and chaos (we follow Axelrod & Cohen's, 1999, distinction here). In effect the argument is that there are three basic ontologies: order, complexity and chaos. Each of those ontologies has a different relationship between cause and effect, and in consequent requires different approaches to management. This is 'multi-ontology' sensemaking of which more later; in terms of explaining things to groups of managers and in government, it has proved easier to start with a simple and readily understood distinction between order and unorder (the first familiar in management education, the second familiar in the context of the family and day to day living but unknown in the field of management science). The other thing that has proven highly effective in practice is not to talk about the unmanageability of unorder, but rather to focus on a key distinction between what is managed. Asking managers not to manage is not a tactic designed to get buy-in to a new concept. That distinction between what is managed can be made as follows:

- In an ordered system one determines a desired outcome or end state, assesses the current situation and then set out a series of steps or stages to close the gap between the two. All things being equal the end state should be achieved;

- In an unordered system, desired end states are not available and seeking to achieve them may blind one to emergent and more desirable possible end, or intermediary, states that may provide competitive advantage including an opportunity to influence or even direct interactions in (for example) a market to increase the probability of a favorable, but unpredictable outcome. In this case one manages the starting conditions: What identities[6] are in play? What are the barriers that can prevent certain types of interaction? What attractors are or could influence identity action?[7];
- Unorder here is being used in the same form as Bram Stoker in Dracula talks of the ‘undead’ something neither dead nor alive but somehow “other” that we can not fully understand or comprehend.

Rules and heuristics

As indicated, this is a scale of ambiguity. Rules, as the exemplar of the low ambiguity end of the scale, represent an attempt to control a situation by laying down what actions should follow a particular situation. The whole management movement towards ‘best practice’, i.e., the concept that there is one right way to do things, is a good example of rules. Within the field of ‘unorder’ the rules of agent based models, which are the most commonly known of complex systems in the world of management, illustrate the same principle, namely a form of crypto-determinism in which rules of behavior are applied consistently, and are either engendered by behavior issues such as self interest, or are genetically entrained or determined by a high authority. In contrast heuristics permit a degree of ambiguity of interpretation. They provide general guidance in which the extremes of tolerable and intolerable behavior are clear, but for which there is a large grey area, where interpretation is key.

The landscape of management

Having established a basic set of distinctions in ontology and epistemology we can proceed to use the resulting matrix (Figure 1) to position complex systems thinking in the pantheon of management science.

Ordered ontology, rule based epistemology

This quadrant has dominated management thinking from the early thinking of Taylor in scientific management to Process Reengineering and the ‘Best Practice’ emphasis of much knowledge management. The basic metaphor is of the organization as a machine which can be designed, structured and planned and which will produce consistent and repeatable performance. The first three of Mintzberg, *et al.*’s (1998) ten strategy schools (design, planning and positioning all associated in some way or another with Michael Porter) all fit within this quadrant and, as Mintzberg points out

were tailor made for the Management Consultants, ably to fly in, apply a recipe using large teams of analytically trained consultants and then move on to the next organization.

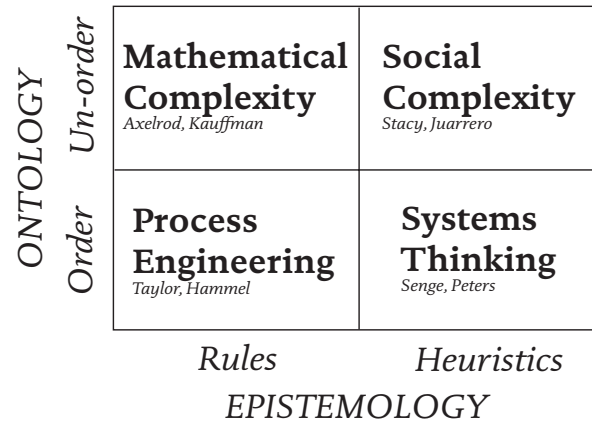


Figure 1 The landscape of management

Ordered ontology, heuristic based epistemology

In the late 80s and 90s we see the emergence of a set of arguments that focus less on the mechanical and more on the human. Rooted in systems thinking the most popular manifestations are associated with three authors - Peters, Senge and Nonaka - all of whom argue for attention to be paid to the need to recognize the human aspects of an organization that cannot be reduced to a mechanical structure. Here we see the growth of the emphasis on alignment of organizations with mission statements and values, in the field of strategy we see the emphasis on core competence as something which in effect has evolved and cannot be defined, but which can be refined. The remaining seven schools of strategy can be accommodated in this quadrant.

Unordered ontology, rule based epistemology

While the origins of complex adaptive systems theory rest in chemistry, biology and physics the most common understandings and published examples reside in agent based models, or in human interventions based on the development of simple rules from which complex behavior can emerge. Examples frequently quoted include the rooting of telephone signals based on ant feeding behavior and the optimization of package distribution in South West Airlines using simple rules rather than complex mathematics. The basic approach is either to discover, or to design rules under which human beings can make decisions which then result in complex phenomena which can be optimized. In the Study we labeled this space as mathematical complexity to reflect the modeling aspects of applications.

While developing the whole concept of unorder and emergence which differentiates it from engineering approaches, it shares with engineering

the concept of rules, but instead of applying rules as a top down control mechanism, they are applied at the level of agent behavior to simulate system levels properties.

Unordered ontology, heuristic based epistemology

More recently there has been a growing awareness amongst some academics and practitioners that human systems are different from those which otherwise occur in nature. While sharing with mathematical complexity the concepts of unordered and emergence, and with frequent use by metaphor of concepts from biology, the various schools in this quadrant all to varying degrees argue with Systems Thinkers that there are unique aspects to human systems that are not present in other natural systems. These are often associated with issues in language and communication, particularly with thinkers such as Stacey and the associated school of 'participative complexity' with their emphasis on the importance of conversation and socially constructed meaning. Other thinkers in this domain who will be well known to readers of *Emergence* are Cilliers (1998) and Juarrero (1999).

Social complexity shares with its mathematical cousin unordered and emergence, but also shares with systems thinking recognition of the uniqueness of human systems and the need to develop a new science of management. Confusion between complexity, chaos theory and systems thinking all abound in popular literature and practice and the model seeks to make it easy to both distinguish between the approaches and also to see their similarities.

Unique aspects of human systems

Different schools of thought identify different distinguishing features of human systems[8]. The following summary has been developed from various sources over the years in the context of creating explainable and comprehensible reasons for management audiences engaged in the early stages of applying thinking from social complexity.

Humans make decisions based on patterns

This builds on naturalistic decision theory in particular the experimental and observational work of Gary Klein now validated by neuroscience, that the basis of human decision is a first fit pattern matching with past experience or extrapolated possible experience. Humans see the world both visually and conceptually as a series of spot observations and they fill in the gaps from previous experience, either personal or narrative in nature. Interviewed they will rationalize the decision in whatever is acceptable to the society to which they belong: "a tree spirit spoke to me" and "I made a rational decision having considered all the available

facts" have the same relationship to reality. Accordingly in other than a constrained set of circumstances there are no rules to model.

Humans create and maintain multiple identities

An individual can be distinguished by their roles, clans or context. We both create and maintain multiple, often parallel, identities shifting between and amongst them as needed without so much as a second thought. As a male individual I can be father, brother, son or husband, I can switch between work based identities or home based ones. My employees if distanced from me may never associate my person with the role I occupy. I am a member of many clans, from sporting clubs, cohort groups, participants in a senior executive programme: there are many examples. Context is of particular interest here, working as a crew in a bush fire by identity is very strongly associated with the role and common threat and I can sustain it for a period of time while I am 'on watch'; however such a contextual identity and the behaviors associated with it cannot be transferred outside of the context. Accordingly in other than a constrained set of circumstances there are no clear agents to be modeled.

Humans ascribe intentionality and cause where none necessarily exist

There is a natural tendency to ascribe intentionality to behavior in others, whilst assuming that the same others will appreciate that some action on our part was accidental. Equally if a particular accidental or serendipitous set of actions on our part lead to beneficial results we have a natural tendency to ascribe them to intentional behavior and come to believe that because there were good results, those results arose from meritorious action on our part. In doing so we are seeking to identify causality for current events. This is a natural tendency in a community entrained in its pattern of thinking by the enlightenment. Deacon (1997) has established that the concept of co-evolution of the brain and language removes the need for a 'universal grammar' as an explanation of language, and a similar application of Occam's razor can remove much of the supposed causality in both government and industry. One of the key insights of social complexity is that some things just 'are' by virtue of multiple interactions over time and the concept of a single explanation, ascription of blame or for that matter credit are not necessary.

Humans have learnt how to structure their social interactions to create order

For the purpose of this article we will avoid the potentially troublesome concept of free will and instead focus on the ability of humans through social structures and less tangible things such as myth, ritual and taboo to create stability and predictability in their systems.

Depending on where you live it is correct to drive on either the left or right hand side of the road, we have advanced from the adaptive nature of bird flocking behavior (fly to the centre of the flock, avoid collision, match speed) as a means of managing traffic, to create a predictable form of order that not only provided stability in our day to day lives, but also allows planning for road design etc. This is linked to the human capacity to store knowledge in the external environment, or 'scaffolding' to use Clarke's (1997) term. Humans have thus learnt how to move between order and unordered.

Couple the above with the phenomenological aspects of human perceptions of reality and we see that there are substantial and major differences between human and non-human unordered. This led us to coin the term 'contextual complexity' in contrast with 'participative complexity' from Stacey, Griffin etc. Contextual complexity argues that humans have the ability to operate in all quadrants of the model and the ability to move between them as a result of both accidental and deliberate action.

Multi-ontology sensemaking then reflects the need to adopt different diagnostic techniques, different intervention devices and different forms of measurement depending on the ontological state. This is contrasted with any single ontology form of sense making whether based on order, complexity or chaos. Understanding this concept of ontological switches also helps prevent the degeneration into 'un-manageability' and fatalism which can occur when people start to understand complexity-based thinking.

It is interesting to note two common confusions in management science in this respect.

The confusion of correlation with causation

The various ordered systems approaches, both process engineering and systems thinking, together with their various derivatives all tend to confuse correlation with causation. The dependence on case material to create retrospective validation of the theory, or to illustrate so called best practice naturally leads to this. Much research in management science makes a basic error in logic in assuming that because successful companies have certain types of organizational structure, strategic process or whatever, that the assumption of those organization structures or strategic processes by another company will lead to that company being successful. This is the confusion between properties and qualities taught in 101 philosophy: just because I see a Frenchman wearing glasses it does not follow that all Frenchmen wear glasses and even less so that if I put on glasses I will become French!

The confusion of simulation with prediction

Some of the manifestations of complex thinking share this confusion, partially accountable for by the strong bias to case-based reasoning in management literature. However they also have another confusion, namely that of simulation with prediction; agent-based models are very powerful, but because I can simulate something which mimics real life, it does not mean that I can predict the future. I can simulate the flocking of birds, but I cannot predict when they come to a mountain whether they will pass to the left or the right of that mountain.

Paradox and confusion

The majority of business practice assumes a single ontology approach to sensemaking, seeing order as something either self-evident or discoverable, interestingly continues the Kantian dichotomy between things which can be known empirically, that which is unknowable which belongs to God, otherwise known as 'gut feel' or inspired leadership. Paradoxically, executive behavior in the home does not follow the dictates of order, but instead conforms to good practice in the management of unordered systems. One imagines the business leader returning home after the completion of typical piece of business planning to manage the party for a teenage daughter. Imagine the scene - learning objectives are set for the party, a project plan is produced based on a series of scenarios of possible outcomes. Milestones are established with empirically validated measurements of success to check that the party is progressing against management objectives. The party starts with a motivation video and incentive packs are handed out to the teenagers to make sure that their personal preferences are subsumed in the wider learning goals of the organization. At the end of the party, an after action review is held, processes are updated and new practices mandated. It's a nonsense, no self respecting parent would even attempt such a process. Instead boundaries or barriers of acceptable and unacceptable behavior are set and negotiated, attractor mechanisms (location of the disco, parental purchase of certain types of alcohol, parental presence) are determined and monitoring systems set in place. No one attempts to define what a good party would be in advance, but several 'bad party' options are considered and planned for. At the end of the party we know if it has been good or bad, but we could not predict the goodness in advance.

The above story has proved an excellent way of getting working managers to understand the difference between ontologies, and also to assist them in realizing that unordered is in fact a familiar space - they already know how to manage, we just need to apply some science to make it consistent and scalable. Hopefully the model and its use in the Study will provide some

assistance in understanding the differences between the two, and thus the application of appropriate management theory; by doing so we potentially break the fad cycle of management theory and allow past practice to be accommodated within boundaries, while creating space for new practice.

References

- Axelrod, R. and Cohen, M. (1999). *Harnessing complexity: Organizational implications of a scientific frontier*, New York, NY: The Free Press.
- Barabba, V. P., Pourdehnad, J. and Ackoff, R. L. (2002). "Above and beyond knowledge management" in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, p. 359.
- Blackler, (2002). "Knowledge, knowledge work and organizations," in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, pp. 50-51.
- Boisot, M. (2002). "The creation and sharing of knowledge," in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, p. 66.
- Borghoff, U. M. and Preschi, R. (eds.) (1998). *Information technology for knowledge management*, Springer.
- Choo, C. W. and Bontis, N. (eds.) (2002). *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press.
- Christensen, C. and Raynor, M. (2003). "Why hard-nosed executives should care about management theory," *Harvard Business Review*, September: 67-74.
- Cilliers, P. (1998). *Complexity and postmodernism*, Routledge.
- Clark, A. (1997). *Being there: Putting brain, body, and the world together again*, MIT.
- Deacon, T. (1997). *The symbolic species*, Penguin.
- Drucker, P. (1994). *Post-Capitalist Society*, Harper Business.
- Garud, R. and Kumaraswamy, A. (2002). "Technological and organizational designs for realizing economies of substitution," in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, p. 233.
- Grant, R. M. (2000). "Shifts in the world economy: The drivers of knowledge management," in C. Despres and D. Chauvel (eds.), *Knowledge horizons: The present and the promise of knowledge management*, Butterworth-Heinemann, pp. 27-54.
- Grant, R. M. (2002). "The knowledge-based view of the firm," in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, p. 134.
- Griffin, D. (2002). *The emergence of leadership*, Routledge.
- Harrison, E. (2000). *Cosmology: The science of the universe*, 2nd edition, Cambridge University Press.
- Juarrero, A. (1999). *Dynamics in action: Intentional behavior as a complex system*, MIT Press.
- Krogh, G. von and Grand, S. (2002). "From economic theory toward a knowledge-based theory of the firm," in C. W. Choo and N. Bontis (eds.), *The strategic management of intellectual capital and organizational knowledge*, Milton Keynes, UK: Open University Press, p. 163.
- Kumar, K. (1995). *From post-industrial to post-modern society: New theories of the contemporary world*, Blackwell.
- Kurtz, C. and Snowden, D. (2003). "The new dynamics of strategy: Sense-making in a complex and complicated world," *IBM Systems Journal*, 42(3): 462-483.
- Mintzberg, H., Ahlstrand, B. and Lampel, J. (1998). *Strategy safari*, Prentice Hall.
- Stacey, R. (2001). *Complex responsive processes in organizations: learning and knowledge creation*, Routledge
- Sveiby, K. E. (1997). *The new organizational wealth: Managing and measuring knowledge-based assets*, Berrett Koehler.

Notes

- [1] This idea is given an excellent appraisal in Harrison (2000: 20), where he describes a principle of plenitude, which he attributes to Plato as "The earth necessarily displays every form of reality in inexhaustible abundance. This is the principle of plenitude that saturates Western culture."
- [2] A term we have coined and illustrated, for example, in the way many consulting companies train and use graduates within their workforce.
- [3] This is often claimed by SME suppliers to UK supermarkets.
- [4] There are important exceptions to this, such as SMEs working in the automotive industry, although they frequently still rely on a single major customer.
- [5] Ontology is not used here in the technology simplification of the word to mean a glorified form of taxonomy, but in the philosophical sense of the fundamental nature of things.
- [6] 'Identity' is used here in the place of 'agent' as a distinguishing feature of human unorder and will be explained later.
- [7] This forms part of the ABIDE intervention model for unordered systems created by one of the authors (and colleagues) publication reference awaited. ABIDE stands for attractors, barriers, identity, dissent and environment.
- [8] Further material on these differences and their impact on strategy is to be found in Kurtz & Snowden (2003).

Acknowledgements

The contribution of Max Boisot, Rod Shelton, Jonathan Sage and others to the original report, of which this paper is a summary, is hereby acknowledged although they cannot be held responsible for the conclusions and summary material in this paper. The content of this paper represents the authors' opinions alone.

Dave Snowden is Director of the Cynefin Centre for Organizational Complexity, which focuses on the ap-

plication of complexity theory to organizational issues. David has an MBA from Middlesex University and a BA in Philosophy from Lancaster University. He is adjunct Professor of Knowledge Management at the University of Canberra, an honorary fellow in knowledge management at the University of Warwick, Adjunct Professor at the Hong Kong Polytechnic University and MiNE Fellow at the Università Cattolica Del Sacro Cuore in Italy. He teaches on various university programmes throughout the world. He regularly consults at the board level with some of the world's largest companies as well as to Government and NGOs. In addition he sits on a number of advisory and other bodies including the British Standards Institute committee on standards for Knowledge Management.

Peter Stanbridge is Director of Korora Limited, an SME software development and IT consulting company. Peter specializes in knowledge management, e-business and business intelligence consulting and has previously worked for PricewaterhouseCoopers as part of their global knowledge management team. Recently he has worked with IBM Business Consulting Services Belgium on research projects relating to business eco-systems and virtual organizations. Peter can be contacted at peter.stanbridge@korora-ltd.com.