

# **Strategy, Knowledge and Information Organization Systemic Evolutionary Perspectives on Complex Systems**

Keywords: strategy, evolution, information, complex systems, innovation, knowledge

## **Abstract**

This paper draws together research and perspectives developed by strategists and strategy researchers, economists, sociologists, biologists and physicists to find a common basis for complexity approach to natural and social sciences. Conceptually, it is based upon a ‘epistemological-cognitive’ interpretation of evolution as learning process that accumulates information and transforms it into ‘knowledge’ via codification and structural organization of this knowledge. An epistemological view can also be applied to organizations. For instance, strategy and management as a process of social evolution are about the selection and recombination of new variants in often modular and complex social and material structures, which are in turn influenced by actors’ perceptions about these structures. These material elements and their mental representations are selected and recombined during processes of social evolution and in need of be adapted to each other, which may explain the particular paths of social developments in the past.

## **1 Strategy and Knowledge Evolution**

### **1.1 Defining the issue**

Here we intend to develop a perspective on strategy development and organizational decision-making based on how information is organized into mental and material structures and how it affects the course of knowledge growth. If successful, this permits to transfer knowledge of processes, patterns and mechanisms associated with specific problems particularly in evolutionary biology to the social sciences, as far as principles of information organization operate in both domains.

The core problematique in strategy is the interpretation of information about the state of the environment and choosing or developing the right ‘answer’ so as to achieve one’s goals, which are dependent on the perceived state of the environment

respectively its potential future state(s) (Weick 1987). Thus strategy making and strategic management are related to issues of how we know and what we can know - called epistemology in philosophy. Problems in the conception, planning and implementation of a strategy are often related to what (organizational) actors do (not) know, how they perceive, filter and interpret information and structure their actions and organizations accordingly (see Leticche 2009, Seidl 2007, Tsoukas 2000 for different perspectives on this matter). This is often strongly influenced by the systems, processes and rules of organizations through which information are 'processed' and subsequent framing of alternatives by risk-averse managers (Christensen and Bower 1996), leading to systematic 'routinization' (Nelson and Winter 1982) of decisions in specific corporate cultures focusing on particular technologies, products or market segments. In turn, strategic decisions in organizations may open niches for innovative entrepreneurs (Schumpeter 1934, Christensen and Bower 1996). Therefore strategy, information gathering (tools) and knowledge are fundamentally related (cp. Prahalad and Hamel 1994).

Seemingly, phenomenological patterns of knowledge development conform to interrelated patterns of stasis, gradual and radical change, which have been discovered by biologists (Gould and Eldredge 1972) and explained by chemical (e.g. Eigen and Schuster 1979, Kauffman 1993) and physical models (e.g. Bak and Sneppen 1996, Crutchfield 2001). Such patterns have also been described by social scientists, e.g. Miller and Friesen (1980) for organizations, Sahal (1985) for technologies, e.g. Klepper (1997) for industries, and e.g. Achilladelis and Antonakis (2001) for innovations. This raises the question how one can account causally for the occurrence of these phenomenological patterns in the social science area. In social systems this information expression takes place via actors' mental representations, which adds an explicit cognitive layer relative to the 'natural science.' area. However, the common occurrence of such patterns in natural and social science furthermore suggests that information organization, its expression in material structures and its effects on patterns of 'innovation' might be a basic element common to the social sciences, biology and physics. This in turn suggests, that the different disciplines can exchange heuristics, approaches, tools and models and thus learn from each other.

In analyzing this process, the social sciences area have the advantage that one can inspect processes of information processing 'live' and real-time, observing processes

on a scale that do not necessarily require complicated and costly tools. However, social sciences have also the disadvantages of ‘observer-dependence’, i.e. feedback effects from analyses on processes to be analyzed. This is one area where physics - which shares some of these problems in its domains - may provide further analytical and philosophical inputs to solutions.

If one starts to look for the most fundamental elements and processes in the universe one can hardly escape the importance of concepts of matter, energy, and information, which might all be related to each other. Information is with us since the beginning of the big bang, evolving into embodied knowledge in organisms over our evolutionary history and ‘culminating’ in more explicit social and psychological processes of knowledge storage and information exchange (Maynard Smith and Szathmary 1999). The issue is also interwoven with the philosophical problem of what we can know as well as debates on emergence (see e.g. Auyang 1998). One perspective that has explicitly focused on the relationship between evolutionary development principles of complex structures and epistemological of information is systemic evolutionary theory.

## 1.2 Systemic Evolutionary Theory

A perspective from evolutionary biology that has addressed some of these issues is systemic evolutionary theory (Riedl 1977, 1978). This theory focuses on the internal organization and selection of organisms, and links into punctuated equilibrium and complexity theory to explain the growth of functionally interrelated complex adaptations going beyond the Neo-darwinian Synthesis (cp. also Turner 2008). It is argued that morphological and hierarchical constraints in the organization of information govern the evolution of biological systems (and affect the perception apparatus of human beings). The emergence of stable species requires a balance between traditional structures and variation. At times these constraints are broken, which leads to a realm of opportunity for exploration and (relatively) rapid change (Gould and Eldredge 1972, Crutchfield 2001). Stability of species and their structures over long time horizons results from information molten into structure kept adaptable through modularity and niches for trials. Adaptive change is made easier by switching aggregated decision-complexes or modules (Riedl 1977). These may be preserved or developed in ‘niches’ of different functions until they become sufficiently functional

or the need arises for them. At that point a shift of function is evolutionary possible and the 'sudden' emergence of complex adaptation may occur.

Systemic evolutionary theory is also closely connected to an epistemological view of evolution. Mutations are seen as hypotheses that are tested in the biological environment. Successful selection of variants leads to the build up of knowledge about the life-world of a species. From this perspective, selection provides 'feedback effects from 'the environment on the medium that carries information over successive generations.

Embodied knowledge is built up cumulatively, while information about the environment is structured systematically in the hierarchical organization of the organism, which also affects the information it can process. This process of systemization influences the direction of evolutionary processes. One can argue that evolution thus constitutes a learning process where knowledge about the environment and strategies to deal with this environment are transformed into knowledge contained in the genetic and behavioral 'programs' of organisms.

This links into evolutionary epistemology, which has been linked by Konrad Lorenz to Kant arguing that the evolutionary process 'produces' the a priori of animals and man over successive co-evolutionary adaptation cycles (Lorenz 1977). Vice versa learning processes in the social system can be seen as expression of evolutionary processes where information is selected and cumulatively built into the social corpus of knowledge, institutions, and organizations.

## 2 Systemic Evolutionary Management

### 2.1 The Relevance of Systemic Evolutionary Theory for Organization and Management?

One area in the social sciences where information, knowledge and its interpretation are of utmost importance are strategy-development and strategic management. The argument so far suggests to use an evolutionary formulation of the process of knowledge growth in social systems to the information of strategy-making.

We can learn from the adaptive systemic organization of nature 'tools' to balance the needs for stability and change, for exploration and exploitation (Smith and Tushman, 2005). The social equivalent to the above description of could be a

department with certain knowledge and capabilities developed for a different function, which gets reused. Systematization of information serves as a method or tool to systematize information about the environment in consistent structures and increase the adaptation speed to a changing environment.

The distinct element of human / social systems are foresight and the ability to plan for the future. Testing occurs in the mental world before it is realized. The 'only' issue might be that testing is too critical. It is first hypotheses and then material expressions thereof that are subjected to selection instead of organisms (Lorenz 1977). This is the innovation problem of how to develop a new product or technology until it is socially and commercially accepted, usually despite strong criticism and / or neglect by potential users.

Tools to alleviate the situation are:

An openness of mind, which allows to and involves repeatedly challenging core assumptions of business models and strategies. These are often institutionalized as once a year strategy breakout session. However the need may arise at different times. How to identify when the need arises? Get on the meta-perspective level: Be aware of constraints and assumptions built into (your) business models, models of the industry so as to identify changes that signal

a) when limits of model are approached and

b) when limits are breached and the model has to be re-evaluated and possibly changed. This issue leads us directly to:

## 2.2 The Problematique: Strategic Management of Changing Structures and Paths

The problem that arises from systematized decisions in the form of structures and modules is twofold: maintaining stability and adaptability at the same time, i.e.:

a) How to maintain adherence to the defined structures and decisions rules in the face of a natural tendency for human / social systems to drift, change and evolve. The solution for this are formal structures, organization charts, role definitions, decision rules intended to lead to effective organizational processes and reasonable decisions

but in practice result often in bureaucracy and red tape.

b) How to switch paths of action, change strategies in the face of external needs for change, adaptation pressure from e.g. changing regulation and customer demand, given that one has instituted an organized structure aimed at stability.

The issue in switching paths is how to jump from one good, established technology, markets, strategy or organization form to one that is still inferior, but that promises to be superior in the future, given further development. Research, planning and monitoring are the methods to achieve this by learning about the environment and making plans on how the environment and the companies (re)actions in this environment should look like (Hamel and Prahalad 1994).

In that respect, the question for managers may arise how to manage the transition between two differing paths of adaptation, particularly when there are diverging interests and opinions on the viability of the new versus old field of business. Thus, strategic management requires answers to whether and if so when and how to switch strategic paths. This requires an analysis of actors perceptions and how these are grounded in their mental representations, which are based on learning, experiences and socialization.

### 3 Strategy and Strategic Management as Evolutionary Learning

As strategy development is a heuristic process about one's situation in a changing environment and the required answers to reach a defined goal (which might also be redefined in the course of action) it is an example of information processing and condensation into knowledge. It takes place via actors' heuristics, involving organizational procedures, management information and reporting systems, which lead to - sometimes flawed - interpretations. This description reflects important elements of Herbert Simons' research programme ranging from learning to organizational issues to computing (e.g. Simon 1996).

Strategy can be conceived as the outcome of day-to-day actions in response to changing requirements (Whittington 1996, Hendry 2000). Mintzberg (1994) has argued that a realized strategy is the outcome of the interaction between the intended

and an emergent strategy resulting from the tension between deliberate (planned) strategy and the impact of environmental forces. This process results in evolutionary paths of strategy-making behaviour and strategic outcomes, following patterns developed in the past, getting stuck in dead ends or exploring new domains or forms of organizational change (Meyer, Gaba and Colwell 2005).

Strategy research has often -though not always - focussed on the connections between the elements of strategy, structure, conduct and performance (e.g. Chandler 1962, Rumelt 1974). This approach has been criticized because of the limited causal proof of the links between these elements

(e.g. Miller 1979). For instance, Rumelt (1991) has called for an evolutionary approach to the analysis of the development of industries. And indeed, on the macro-level of observed outcomes, an evolutionary approach to strategy can build on the knowledge developed in ecology and evolutionary theory (e.g. Hannan and Freeman 1989, Nelson and Winter 1982, who build in turn on March and Simon 1950). However the micro-level of evolutionary processes in social systems is still subject to debate (Hodgson 2003). If such an evolutionary analysis is not to stay on a phenomenological level just 'correlating' changes in several areas, one needs a causal micro-story of how strategy comes about. A potential perspective filling this need has been proposed by 'strategy-as-practice' researchers (Whittington 1996, Hendry 2000) as the strategy-as-practice aims to develop a micro-perspective on strategy-making.

However, the strategy-as-practice approach suffers from another problem: as far as it aims to be an observational / descriptive approach of micro-level activities, one practical problem is the conceptual connection to and practical implementation of link between micro-level actions and macro-level outcomes. Thus we are left with a two sides of a medal, which somehow still seem to miss their connection. If the observations of the strategy-as-practice perspective are conceived as part of such an evolutionary learning process that is constrained and directed by the mental and organizational structures of actors, then this problem can be 'solved'. Parts of this type of epistemological evolutionary process model has indeed been described e.g. in organizational and strategy research (e.g. Daft and Weick 1984, Weick 1987), evolutionary institutional economics (e.g. Veblen 1898, Handlbauer 1997) and philosophy (e.g. Rescher 1977). Thus, a combination of a micro-level approach such as the strategy-as-practice perspective and an evolutionary 'macro'-level perspective

on organizations and strategy can contribute to the analysis of intended versus emergent strategic actions and how they result in aggregate patterns of strategic and innovative behavior. The glue between these two perspectives can be provided by a systemic organizational view on strategy.

#### 4 Cognitive Landscapes, Information Organization and Knowledge Evolution

Building on a cognitive and evolutionary view of strategic management and strategy, we will touch upon postmodernist positions and return to an evolutionary view as tool to integrate the relativistic postmodern conception with a realistic view.

As mentioned in the beginning, the problem of switching paths in management decisions depends on managers' perception about costs and benefits of doing so framed by organizational processes and systems. The answer consequently also depends on actors' perspectives, for example the mental frames acquired through training and experience as well as political interests. Usually these are slightly different from individual to individual, department to department and company to company. These differing perspectives have been described in postmodern / poststructuralist / critical perspectives in a variety of fields, giving rise to - depending on the authors position - claims or accusations a relativistic 'anything goes'.

However, heeding what we have said above on the evolutionary nature of human (inter-) actions, these different perspectives can be captured in an evolutionary model, of cognition – action dynamics as elements in one or more 'populations' of 'schools of thought'. In conclusion, the cognitive 'landscape' concerning a field of concepts actors in strategic management harbor can be seen as the analogue to a set of genes in evolutionary biology (called replicators by Hull (1988), cp. Nelson and Winter (1982)). In line with von Mises we see "the way to a cognition of collective wholes (...) through the analysis of individual actions" (von Mises 1949, 42), adding the cognitive layer of mental representations to this analysis.

To do so, one perspective from psychology that seems useful in an evolutionary characterization of social processes is personal construct theory (Kelly 1955, Addams-Webber 1979, Bannister 1985). It posits that humans perceive and structure their world mentally along dichotomous conceptual poles. These concepts can be seen as elements in interrelated cognitive maps of concepts. These describe the structure

and content of actors worldviews and have been applied to strategy and management issues (e.g. Eden et al. 1992, Fiol and Huff 1992).

Researchers can construct binary orderings of finite constructs by applying Boolean set theory to cognitive maps of actors. This method, called repertory grid, is based on the analysis of correlations between the structure and elements of cognitive maps between actors or between actors and some real phenomenon. Thus a concept is represented by a process of dichotomous splitting of the attributes perceived relevant by actors leading to a hierarchical tree structure of attributes.

The correlation between the mental structure of perceived attributes and the structure of real world phenomena can be measured over time - showing the process of individual and group learning. If the concept is transferred to groups of people one may be able to identify different systems of belief between different groups of actors. By assigning numerical values to the degree of difference between these belief systems empirical measures can be easily constructed. Likewise the evolution of such cognitive architectures – if sufficiently identifiable from historical documents - should allow the tracking of mental representations over the past. Thus researchers should be able to relate changes in mental representations with effects in the real world over longer periods. This theoretical structure would allow for the transfer of biological evolutionary theory to the social sciences as well as providing the necessary differentiation of evolutionary approaches for social systems.

To do so requires a representation of the information in actors. This can be achieved by capturing the world view of actors regarding specific issues in cognitive or cause maps. (Eden et al. 1992, Fiol and Huff 1992). Cognitive maps in turn can be transformed into a binary tree using the repertory grid method, which is based on binary categorizations of elements (concepts) of cognitive maps (Kelly 1955, Bannister 1985). The place of individual concepts in the hierarchical structure of these binary trees corresponds to the ease or difficulty with which they may be changed – their ‘burden’ to take over a concept from systemic evolutionary theory. The issue of adaptability vs. ‘burden’ is discussed under the heading of inertia in organizational studies (Zuckermann 2010). The resultant patterns of change look like avenues or pathways of ‘logical’, incremental change until they are broken by radical innovations that give rise to the exploration of chaotic variety, until selection sets in and stabilizes developments again - which can be described by models of selforganized criticality

(Bak and Chen 1996), catastrophe theory (Thom 1989) and / or network theoretic accounts (Jain and Krishna 2002).

Thus, we can argue that the perceived characteristics of the real world depend on the individual elements of mental representations, which form constructs and the structure of cognitive maps.

Actions and decisions taken on the basis of mental representations are influenced by perceptions and in turn influence the states of the world. Structurally, this circular process is a process of (co-)evolution by learning about and affecting the real world (see Figure 1).

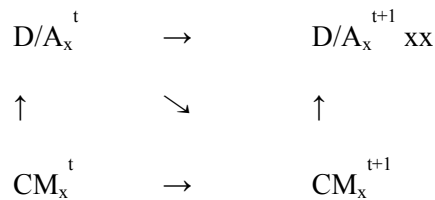


Fig. 1: Interdependence between an Actor's Decisions / Actions and Cognitive Maps

What we perceive here as basis of social evolution is a heuristic cycle of learning: The set of perceptions of an individual  $x$   $CM_x$  at time  $t$  governs the set and configurations of characteristics embodied in an artefact or action  $A$  (or decision  $D$ ) at  $t$ . The experience of actors with this set influences the set of mental representations at time  $t + 1$ . This governs characteristics of  $A$  at  $t + 1$ . The change of the set of perceptions at  $t + 1$  is can also influenced by 'independent' learning from other sources than directed experience with  $A$ . The set of characteristics at  $t+1$  is constrained by material, institutional and mental constraints.

If we deal with several actors (see Figure 2) we have several perceptions, cognitive maps and their application in the real world. Communication between individuals  $x$  and  $y$  by means of labels ( $La$ ) is seen as sending and reception of signals between actors. Signals can also be taken up by observing the environment. Labels, or communication signals, lead to structural coupling between communication acts to use the language of Luhmann.

Luhmann<sup>1</sup> develops a conceptualization of social systems that starts from Talcott Parsons structural functionalism, but turns it on its head and speaks of functional structuralism.<sup>2</sup> Luhmann based (the later part of) his work on the concept of autopoiesis developed by Maturana and Varela,<sup>3</sup> radical constructivism and systems theory. In doing so, he uses a cybernetic concept of communication as sending and receiving of signals.

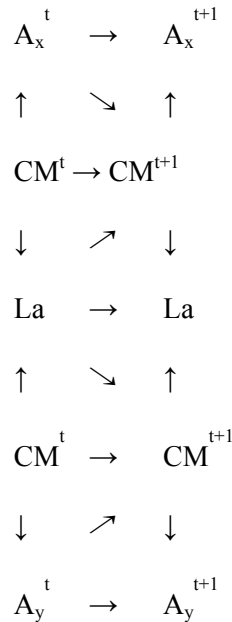


Fig. 2: Interdependence between Two Actors' Cognitive Maps

Luhmanns aim is to develop a more general, emancipated account, which results

---

<sup>1</sup> For a short, but clear description of Luhmanns argument see Bechmann and Stehr (2002), Vanderstraeten (2002) w.r.t. double contingency and Chernilo (2002) w.r.t. symbolic media, and Luhmann (1990) himself for a set of well written English essays on the main points of his argument. Later Luhman (1997) has explored the more macroscopic implications of the Luhmannian micro-view described here. That description matches quite well with the systemic evolutionary view as well as evolutionary economics described below.

<sup>2</sup> Parsons based his work on traditional ontological concepts such as norms and values, actors and interactions between these that stem from the origin of sociology and modern industrial society.

<sup>3</sup> Autopoiesis refers to a autocatalytic network of chemical structures, where one element catalyzes the production of another element in a circular fashion, thus stabilizing the whole entity. It adds Eigen Schuster's hypercycle concept an added focus on the self-creation of molecular networks, which has sometimes (wrongly) been associated with a teleological stance.

in a more radical conceptualization that reduces the social to the operation of (cybernetic) communication processes.<sup>4</sup> Luhmann rejects classical epistemological separations between theory and subject. Rather, he argues that the world, defined by the horizon of what is perceived by different actors, is described by means of a network of contingent labels. These labels (La) operate relative to what is assumed, communicated, or constructed to be given (in CMs) at a certain point in time and in a certain environment. These labels are context dependent distinctions (or differences) that are constructed in reference to distinguishable alternatives. This happens in networked autopoietic systems that:

“are not only self-organizing systems, they not only produce and eventually change their own structures, their self-reference applies to the production of other components as well. This is the decisive conceptual innovation. Autopoietic systems are sovereign with respect to the constitution of identities and differences. Social systems use communication as their particular mode of autopoietic reproduction. Their elements are communications that are recursively produced and reproduced by such a network of communications and that cannot exist outside such a network.”

Luhmann (1990, 3).

Communication requires understanding and meaning, 'and meaning can be understood only in context, and context for each individual consists primarily of what his memory supplies.' (Luhmann 1990, 88). Thus, communication is rather more improbable although it happens daily. In Luhmann's theory, communication implies selection through the actors among alternative interpretations and meanings in the course of producing communication acts. This gives rise to double contingency in the Luhmannian sense when two autonomous actors ('alter' or x and 'ego' or y) meet (where the case of full double contingency is seen as a conceptual limit). Communication is seen as a process that creates the social sphere by selection from among alternatives in a self-referential mode.

---

<sup>4</sup> In contrast, Habermas work focuses on the coordination of actions, that is how the problem of integration in modern societies is solved. One can argue that Habermas then goes on to analyze the detailed how of communication, while Luhmann focusses on its system-functional role.

## 5 Physics, Philosophy and Reflexivity

In Luhmann's world, actors communicate about their interpretations of reality. Acts of communication constitute the social sphere. However, quantum physicist Bohr argued in the Bohr – Einstein debate in 1927 at the Solvay Institute of Physics that a description of reality is incomplete if it does not include a description of the observation instrument as well. The observed reality (nature) is due to the occurrence of an interaction between nature and instrument. For the social sphere the observer and his cognitive 'architecture' influence the observed result. From psychological perspectives on therapy we know that that is also true for social interactions. For instance, observations in the systemic (Bateson 1972) and neuro-linguistic paradigm (Bandler and Grinder 1975, Walker 1996) confirm that people often - though not always - tend to 'go along' prejudices that underlie the interactions of others with them. This behavior constitutes one solution to Luhmann's socio-psychological version of double contingency. Additionally, according to Bohr, there is for every description of reality one that contradicts this description. However, Bohr does not accept to solve this contradiction with a dialectical synthesis that integrates counterpositions. Rather, he argues that the cause that shapes developments must at least have a size of Planck's quantum  $h$ . To a certain degree this is a recurrence to the modernist position.

Applied to social systems Bohr's position could mean: the observer and the observed entity influence (or maybe even) shape each other. There is one condition though (in analogy to Planck's quantum  $h$ ): the influencing agent must operate (or live) at least on the same scale as the observed or influenced actors. This brings us to the issue of reflexivity (e.g. Beck 1987, Giddens 1984). The author of this article prefers the formulation that 'Being determines consciousness and consciousness determines being' to show the interrelatedness of mental and real states and processes in social evolution. In this way, social evolution and the process of history unfolding can be seen as co-evolutionary process that combine the two sides of a coin. History is a process that is governed by institutions and human actions, which often seems pretty stable and determined but at other times seems to go through periods of high degrees of self-reinforcing change and high susceptibility to the impact of individuals.

## 6 Evolutionary Solution to Postmodern Perspective inflation

So far we have argued that the process of social interactions gives rise to a co-evolutionary process of counter-influences in the mental and real realms that lead to the accumulation of explicit (in social actors) or implicit (in animals, artifacts, social structures and institutions) knowledge. The history of social systems is thus a process of constrained variation that is governed by legal norms, social values, and institutional and cognitive structures. These constrain and enable the generation of variation and selection of actions and that shape developments in an interplay of differentiation and dialectic synthesis. The dialectic nature of the process is explained by the dichotomous nature of human thinking in personal construct theory.

Thus social evolution - much like biological evolution - is a process of knowledge growth based on the interaction between hypotheses about the world and feedback from their application in the real world. Mental representations are dependent on actors' hierarchically organized cognitive maps (CM). In the course of social evolution, a population of entities of cognitive maps and related institutional or material 'expression forms' is perceived to be endowed with certain characteristics, which leads to decisions (D) and/or actions (A). This in turn affects the population of entities as well as the set of characteristics they comprise. In a further turn it affects the future mental representations and cognitive maps of actors and again their actions and the set of entities.

The resultant change opens opportunities for exploitation through entrepreneurship and innovation. It correlates with a decrease in certainty about the direction of change and the right decisions. This uncertainty is usually reduced through negation of uncertainty and counter-arguments by specific schools of thought or practices (Lefebvre & Letiche, 1999), or absorption (Tang 2009) in specific groups of actors, thus leading to a proliferation of 'competing' alternative options and perspectives between groups of actors. The 'inflation' of individual perspectives that is reflected in postmodernist, critical and constructivist perspectives thus can be leveraged for social analysis, if we assume that views of actors form elements in a population that are largely similar but differ in little details around a centrally agreed upon view. Opposing schools of thought can be traced to specific differences in the hierarchically structured mental representations of actors, which influence agency (cp. Muhonen 2007). The distribution forms over these views, their determinants and their

effects are an important research question in a combined Batesonian-Simonian research program on cognitive evolution.

The observed phenomenological patterns of change in the distribution of cognitive maps, decisions and actions are obviously driven by mechanisms of change. On the causal level, these mechanisms must be understood as self-organizing 'change operators' based on the constraining or enabling interaction between actors' (slightly or more strongly) differing mental representations, institutional and material expressions thereof, and co-evolutionary interactions between these. The complexity that ensues can be (and has been) analyzed by mechanistic approaches to individual relations between these. However, the problem of heterarchical relations cutting across largely but not completely hierarchical, modular structures (in the Simon and Riedl sense) remains and seems more amenable to research approaches from physics, complexity perspectives and molecular biology dealing with similar relations in and between genes, cells, organs and organisms.

## 7 Implications for Strategy Research

The 'objectivist' conception of science has been broken in areas of sub-atomic and cosmological dimensions in physics, in areas of psychology and in the social sciences, giving rise to a relativistic world view. Among others, this has spurred post-modern and radical constructivist schools, which focus on the relativistic character of nature of knowledge. Between these camps often fierce battles are fought about the nature of reality and the implications for philosophy, practice and implications of research. Time has come to integrate these views.

Humans are able to build models about how the future will unfold. In this the problem lies in taking the model for granted. The result is then an ossification of mental structures and ways of thinking in organizations along the lines of a tight culture or 'Weltbild'.

It can be argued that the opposition between critical / postmodernist and modernist approaches is one of the level of analysis, the degree of grain in observation and the degree of abstraction. Post-modernist views operate on the micro-level of social interactions and possibly social change and modernist views operate on

the macro-level of larger systems, which are relatively stable. Evolutionary approaches are sandwiched between these two perspectives. They can provide a link between them. Postmodernist and critical approaches to social issues in general and to management and strategy in particular throw a light on the micro-perspective of how variety emerges and develops into specific traditions that shape social interactions, institutions and structures. For an evolutionary approach to these issues the results of such perspectives are a highly relevant input, since it needs this variety to explain how evolution in general and specific developments come about on the theoretical level. It also practically needs these inputs as cases to be able to test whether there are generally valid patterns or even laws (or not) that shape how the micro-level of social interaction maps into the macro-level of aggregated behavior.

If history is an evolutionary learning process that involves actors with distinct perspectives that allow constrained variation, strategy is one process at the heart of variation in that it involves skilful creation, recombination of and adaptation to elements relevant to a goal: actions and decisions of actors, institutional requirements, organizational and technological elements. Perspectives of actors can be and often are equally valid in that they throw different lights on reality. If many perspectives are equally valid and if these may even (partly) contradict each other, these many perspectives need to be combined to understand what is going on. In some cases, perspectives need not be contradicting each other, even if it seems like that, since observations, interpretations and subsequent actions can only be evaluated and tested in conjunction with the conceptual filters that have been used in developing observations and theoretical statements. Thus one may be able to map some of the contradicting observations into a larger complementary or mutually confirming picture.

This gives rise to a standard for scientific practice: try to confirm observations and statements on your subject area from other disciplines/perspectives and use these to test your own theoretical system (filter). Find out why results are deviating from theoretical expectations and change theory, experimental set-up or, or observations accordingly.

In the end this leads to a position of tolerance with respect to other views: they might have something to say that you need in order to confirm your own view. This

can be linked back to the project of enlightenment (in its idealistic version) even if there is not one certain truth. Remember Kants definition of enlightenment, which states that Enlightenment means to leave ones self-inflicted nonage.

Questions in a research program on cognitive – action dynamics are: How does language as a means for representation and communication shape the perception and framing of events of actors? How does this process influence the definition of issues, actions of management the distribution of resources and power and eventually the course of the organization? In the scientific arena this means to use theories as tools to make sense of reality (and not as political instrument or belief system in the fight for scientific or political power).

The implications for the practice of research are the following: First, observe what strategists are doing, then compare that to what they say what they are doing and then to why they say what they are doing (i.e. try to uncover their cognitive architecture). Identify the role of mental representations and (un)conscious distortions in this layered process. Relate actions and mental representations. Use a discussion of differential or residual of distortions to improve strategic / managerial practice, if wanted. One area where this approach seems particularly relevant is the interaction between strategic and financial issues as both are based on interpretation and opinion that shape action and are shaped by the successful observation of actions.

## 8 Conclusions for Strategy Development and Strategic Management

Information and the principles and processes of its structural organization and material expression are of fundamental relevance for the social sciences as well (Simon 1996). In order to develop a coherent perspective and a toolset in order to understand the interaction between information, its organization and its expression in social and material structures in the realm of strategy, it therefore seems useful to analyze data on historical social processes informed by the observation of current social processes, based on tools developed in biology and physics.<sup>5</sup>

---

<sup>5</sup> For instance, the history of pharmaceutical innovations (Achilladelis and Antonakis 2001) shows a pattern of switches between explorative phases with radical innovations and exploitative phases with incremental innovations, which affects the strategy of pharmaceutical and recently biotechnical companies. This pattern can

What we have learned from systemic evolutionary theory calls for flexible, modular organization of tasks, as well as the hierarchical organization of decision-making, which results in systematization of information processing. The advantage of hierarchical and modular systematization lies in a lower cost of processing recurring, similar issues through the repeated use of attained knowledge for recurring problems. However, the costs lie in bureaucracy, decision-lags, inflexibility, rejection of innovative approaches and far too often ultimately firm failure – if the appropriate countermeasures are not taken (Christensen and Bower 1996). In order to maintain organizational adaptability, links between hierarchical layers and modules – in practice often taking the form of an informal organization next to the official structures – and ‘protected’ niches for the development of new approaches are required. In theory this leads to a networked or heterarchical, ‘rhizomic’ form of organization that is able to adapt to changing environments (Crawford et al. 2009, Tsoukas and Chia 2005). However, in practice such a goal remains often unattainable due to the internal social processes of selection, exclusion and filtering in building the worldviews of organizational groups (cp. Letiche 2009, Seidl 2007, Tang 2009, who in this matter agree). Consequently, the effort required in unfreezing such deeply embedded and interrelated social systems of thought and action is immense. This may explain the phenomenological, punctuated pattern of innovation and knowledge growth mentioned in the beginning. Systems of interrelated, fixed ‘structures’ constrain the development of new knowledge and its application in innovations until the system breaks down or is actively broken, leading to an explorative avalanche of new forms build from inclusion of new entities and re-combinations of old an new entities that is subsequently submitted to selection, ‘systematization’ and ‘stabilization’.

## 9 Literature

Achilladelis, B. and Antonakis, N. (2001). “The Dynamics of Technological

---

potentially be explained on the basis of systemic evolutionary theory (Riedl 1977, 1978, Wagner 1983), Eigen and Schuster’s ‘cloud ‘of variations (around an optimal wild-type) which explores variants moving along fitnessgradients as well as physics-inspired ‘complexity’ approaches to evolutionary processes (Crutchfield 2001).

Innovation: The Case of the Pharmaceutical Industry”, *Research Policy*, 535-588.

Auyang, S. (1998). *Foundations of Complex-System Theories in Economics, Evolutionary Biology and Statistical Physics*, Cambridge University Press, Cambridge, UK.

Bannister, D. (1985). *Issues and Approaches in Personal Construct Theory*, Academic Press, London.

Bateson, G. (1972). *Steps to an Ecology of Mind. Collected Essays in Anthropology, Psychiatry, Evolution and Epistemology*, Chandler.

Bechmann, G. and Stehr, N. (2002). “The Legacy of Niklas Luhmann”, *Society*, 39, 67-76.

Campbell, D. T. (1960). “Blind variation and selective retention in creative thought as in other knowledge processes”, *Psychological Review*, 67, 380-400.

Chernilo, D. (2002): “The Theoretization of Social Co-ordinations in Differentiated Societies: The Theory of Generalized Symbolic Media in Parsons, Luhmann and Habermas”, *British Journal of Sociology*, 53, 431-449.

Christensen, C.M. and Bower, J.L. (1996): “Customer Power, Strategic Investment, and the Failure of Leading Firms”, *Strategic Management Journal*, 17, 3, 197-218.

Crawford, K. Hasan, H., Warne, L. and Linger, H., (2009). “From Traditional Knowledge Management in Hierarchical Organizations to a Network Centric Paradigm for a Changing World”, *E:CO*, 11, 1, 1-18.

Crutchfield, J.P. (2001). “When Evolution is Revolution - Origins of Innovation”, in: Crutchfield, J.P and Schuster, P. (eds.): *Evolutionary Dynamics -Exploring the Interplay of Selection, Neutrality, Accident and Function*.

Daft, R.L. and Weick, K.E. (1984). "Toward a model of organizations as interpretation systems", *Academy of Management Journal*, 16, 284-295.

Eden C., Ackermann, F. and Cropper S. (1992). "The Analysis of Cause Maps." *Journal of Management Studies*, 29, 309-324.

Eigen, M. and Schuster, P. (1979). *The Hypercycle: A Principle of Natural Self-Organization*, Springer, Berlin.

Gould, S.J. and Eldredge, N. (1972). "Punctuated Equilibria: An Alternative to Phyletic Gradualism", in: Dobzhansky, T. et al.: *Models in Paleobiology*, Freeman, Cooper and Co., 82-115.

Fiol, M. and Huff, A.S. (1992). "Maps for managers: Where are we? Where do we go from here?" *Journal of Management Studies*, 29, 269-285.

Hamel, G. and Prahalad, C.K. (1994). *Competing for the Future*. Harvard Business School Press, Boston

Hass, H. (1970). *Energion. Das verborgene Gemeinsame*, Vienna, Fritz Molden.

Hendry, J. (2000): "Strategic Decision-making, Discourse, and Strategy as Social Practice." *Journal of Management Studies*, 37, 955-977.

Hull, D. L. (1988): *Science as a Process*, Chicago, Chicago University Press.

Jain, S. and Krishna, S. (2002). "Crashes, recoveries, and 'core shifts' in a model of evolving networks", *Physical Review E*, 65, 026103.1-026103.4.

Kelly, G.A. (1955). *The Psychology of Personal Constructs*, 2 Vols., Norton, New York.

Lefebvre, E. and Letiche, H. (1999). "Managing Complexity from Chaos:

Uncertainty, Knowledge and Skills”, *Emergence*, 1, 3, 7-15.

Letiche H. (2009). “The Dark Side of Organizational Knowing”, *E:CO*, 11, 4, 59-70.

Luhmann, N. (1990). *Essays on Self-Reference*, Columbia University Press, Oxford.

Malik, F. (1993). *Systemisches Management, Evolution, Selbstorganisation. Grundprobleme, Funktionsmechanismen und Lösungsansätze für komplexe Systeme*, Bern, Haupt.

Maynard Smith, J. and Szathmary, E. (1999). *The Origins of Life. From the Birth of Life to the Origin of Language*, Oxford University Press, Oxford, UK.

Miller, D., and Friesen, P.H. (1980). “Momentum and Revolution in Organizational Adaptation”, *Academy of Management Journal*, 23, 591-614.

Mises, L., von. (1949). *Human Action*. Yale University Press, New Haven.

Muhonen, T. (2007). “Wittgenstein’s Ladder in Prigogine’s Universe”, *E:CO*, 9, 4, 56-71.

Nelson, R.R. and Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*, Harvard University Press, Cambridge, MA.

Rescher, N. (1977). *Methodological Pragmatism. A Systems -Theoretic Approach to the Theory of Knowledge*, Blackwell Oxford.

Riedl, R. (1978). *Order in Living Organisms: A Systems Analysis of Evolution*, Wiley, New York.

Riedl, R. (1977). “A Systems-Analytical Approach to Macro-Evolutionary Phenomena”, *Quarterly Review of Biology*, 52, 351-370.

Simon, H. (1996) *The Sciences of The Artificial*, 3rd ed. The MIT Press.

Smith, W.K. and Tushman, M. L. (2005). “Managing Strategic Contradictions: A Top Management Model for Managing Innovations Streams”, *Organization Science*, 16, 522-536.

Schlicht, E. (1997). “Patterned Variation: The Role of Psychological Dispositions in Social and Institutional Evolution”, *Journal of Institutional and Theoretical Economics*, 153, 722-736.

Seidl, D. (2007). “The Dark Side of Knowledge”, *E:CO*, 9, 3, 16-29.

Tang, Z. (2009). “The Application of the Dimensionality Perspective in Organization Study”, *E:CO*, 11, 1, 58-68.

Thom, R. (1989). *Structural Stability and Morphogenesis: An Outline of a General Theory of Models*. Addison-Wesley, Reading, MA.

Tsoukas, H. (2000). “Knowledge as Action, Organization as Theory: Reflections on Organizational Knowledge”, *Emergence*, 2, 4, 104-112.

Tsoukas, H., and Chia, H. (2005): “Everything flows and nothing abides: Towards a rhizomic model of organizational change, transformation and action”, *Process Studies*, 32, 2, 196-224.

Turner, S. (2008). “Homeostasis, Complexity, and the Problem of Biological Design”, *E:CO* 10, 2, 76 – 89.

Vanderstraeten, R. (2002): “Parsons, Luhmann and the Theorem of Double Contingency”, *Journal of Classical Sociology*, 2, 77-92.

Wagner, G.P. (1983). “On the Necessity of a Systems Theory of Evolution and its Population Biologic Foundation. Comments on Dr. Regelman’s Article”, *Acta*

*Biotheoretica*, 32, 223-226.

Walker, W. (1996): *Abenteuer Kommunikation. Bateson, Perls, Satir, Erickson und die Anfänge des Neurolinguisitischen Programmierens*, Klett-Cotta, Stuttgart.

Weick, K.E. (1987) "Substitutes for Strategy", in: Teece, D.T. (ed.), *Competitive challenge strategies for industrial innovation and renewal*. Cambridge: Ballinger, 221-233.

Whittington, R. (1996). "Strategy as Practice", *Long Range Planning*, 29, 731-735.

Zuckerman, E.W. (2010). "Speaking with one Voice: A "Stanford School" Approach to Organizational Hierarchy", *Research in the Sociology of Organizations*, 28, 289-307.