Paper ID: 048

17th ICCRTS

"Operationalizing C2 Agiligy"

Exploring the Limits of Diversity for C2 Agility

Topic 1: Concepts, Theory, and Policy

Alternative topics:

Topic 2: Approaches and Organizations

Topic 4: Collaboration, Shared Awareness, and Decision Making

Erik Bjurström, PhD, Mälardalen University, Eskilstuna, Sweden
erik.bjurstrom@mdh.se

Abstract

C2 agility addresses key issues of cognition, its social context and the very character of knowledge. Consequently, future C2 research might benefit from broadening its theoretical underpinning. Starting out with the question whether diversity can increase agility to gain a richer understanding of the environment and thereby improving decision-making, we explore three different streams of research to analyze how differently they would formulate the research problem:

- The "biases and heuristics" tradition in experimental psychology has increased our understanding of the mechanisms behind deviances from earlier expectations of rational decision making as stipulated in economics.
- With its roots in anthropology, the "situated- and distributed cognition" research has a radically different view on methodology and knowledge, emphasizing the need for interpretation to grasp the intelligibility of human action.
- The "classical organization theory", developed into a genre of its own, heavily emphasizing the negative consequences of bounded rationality expressed in irrational decisions, routines and rules of thumb heavily outweighing attempts of agility.

Although recently converging, these three paradigms generate very different suggestions as to how the problem of the "Limits of Diversity for C2 Agility" should be stated and how this research should be performed. This leads to alternative or complementary recommendations for further research.

1. Why diversity?

Command and control (C2) agility is a fundamental response to the limits of predictability as a consequence of complexity and dynamics in the operational environment. In an interconnected, interdependent and fast-paced world C2 is no longer nice to have, but increasingly crucial for survival and precision of action. C2 agility is about responsiveness to actual and changeable external conditions, rather than only a matter of speed in action and decision-loops (Alberts, 2011). Unpredictability means a challenge to specialization. In a predictable world, external phenomena can be identified, categorized and acted upon according to pre-designed tasks following pre-set standard operating procedures. In an unpredictable environment they cannot: as outcomes are open-ended, phenomena and their consequences are increasingly hard to identify and action has to be more adaptive to changing conditions due to uncertainty and ambiguity (c.f., Weick, 1979). Furthermore, as modern challenges concern not only physical energy and undisputable facts but increasingly also the matter of *understanding* the evolving logic of the operational environment through the eyes of a broad range of actors, *ambiguity* is added to the challenge of uncertainty. Indeed, the very task of classifying actors, and thereby classifying ourselves, is increasingly becoming a challenge added to traditional focus on targeting (Bjurström, 2011). Consequently, there is an increasing need to avoid human tendencies of tunnel vision and continuously unfreeze established knowledge: to learn how to learn over and over again (Baisini, et al, 2011).

Tendencies of tunnel vision are by no means unique to the military profession and C2. It is a general human trait. It is also a trait of specialization and professionalism. As we name things, we thereby frame the situation to fit the professional terms used to identify, analyze and communicate experience (Schön, 1983). What doesn't fit into the frame is disregarded, causing a seeing or blindness of aspect (Asplund, 1970). Consequently, whatever knowledge we have, it will also have a dark side defined by what it leaves omitted (Seidl, 1997). This problem has been identified also in the normally most specialized and most highly ranked academic fora, as a matter of lacking diversity. The notion of *academic tribes* (Adams, 1976) is sometimes used to designate the tunnel vision of researchers staying within their paradigm without putting their knowledge at risk through the encounter with other academic traditions or practitioners' realities.

For some years now, concerns about the *relevance* of research have surfaced e.g., from the leadership of Academy of Management: while their journals are top-ranked and score high in impact factors and their theoretical advancement is rather increasing, the question is being raised to whom it really matters. The remedy suggested by one of the journals' editors, Hillman (2009) was simple: to talk more to each other. Even within the same research communities there may exist divisions and sub-divisions, typically specializing on a specific theme, with a specific methodology and shared assumptions about the criteria of what is good research, etc. Communicating across disciplines and divisions would mean to broaden the conversation to stimulate more rapid knowledge advancement. A possibly greater challenge might be to engaging in a more profound dialogue between scholars and practitioners to make research more practically relevant (ibid.). However, making own research more practically relevant may involve profound challenges to understand not only the viewpoints of others, but also what assumptions that underpin our own knowledge in order to assess possible trade-offs between own traditions and convictions, practical needs and the possible overlapping or paradigmatic differences between theoretical genres.

Commenting on the state of information systems research, Monod and Boland (2007) lamented in their editorial comments over what he saw as a Peter Pan syndrome of failing to grow up in relation to issues of ontology and epistemology – i.e., how we look on the world and how we think that we can gain knowledge about it. As they argued, the basic problem of this research is the absence of reflection over the very character of the object of investigation – information systems – and the possible ways of getting knowledge about it, leaving research results depending upon naïve belief in causality and objectivity, more reminding of out-of-date 19th century physics than rigorous modern science, such as physics. According to their analysis, the failure of information systems research to solve practical problems lies in the attempt to know everything about nothing, ignoring fundamental problems of even defining the object of research and the possibility of *intersubjectivity* as a substitute for an unattainable objectivity. Hence their recommendation was to step aside from the hope of full objectivity and rationality to instead seeking to be reasonable, suggesting that for every object, we should always have multiple points of view, aiming at an intersubjective dialogue about results at the best (ibid.).

In similar vein, but from the view of the discipline of psychology, Gigerenzer (2008) discussed different orientations towards research: topic-oriented and discipline-oriented research. Whereas research that aims to become practical would gain considerably from being topic-oriented, most of psychology practices the *discipline-oriented* version of science. This in turn typically also involves territorial behavior, not speaking to others and showing little curiosity or even awareness of other people's knowledge about the same topic: looking down on everyone else as inferior or – at best – irrelevant. As he remarked, discipline-orientation also goes hand in hand with *methodological uniformity*, encouraging controlled laboratory research generating zillions of variations of a toy problem, which only with difficulty can be related to a practical problem somewhere. As Gigerenzer saw it, a crucial way to increase research quality would be to create an environment to overcome the *anxiety* of exposing one's ignorance and instead open up for human curiosity to learn.

With these considerations, looking at the problem of diversity in C2, the challenge takes on a holistic character. In the face of the critique and self-critique of different theoretical genres and research paradigms with relevance to C2 research, it would seem strange to go about the investigation of *diversity in C2 agility* without asking any question about possible *diversity in approaches to the problem*. To take on C2 agility with a discipline-oriented view, with its following methodological uniformity may even seem self-contradictory. If the general observations about humans' bounded rationality and tendency to only grasp a little part of any situation or problem wouldn't concern researchers, aren't we implicitly suggesting researchers to be more divine than human? While such tendencies may be frequently observed in academic life, it is a serious moral question to ask oneself, whether there is any room for such territorial and tribal behavior in applied research of any greater societal importance and in relation to professional development of any dignity. While discipline-orientation may be functional or even necessary to cultivate academic expertise in any area of new or basic research, it is clearly dysfunctional and unnecessary in the use of mature research traditions into applied research and development as well as in its extensions into doctrines and professional training.

In similar vein, while methodological uniformity may be an important expression of discipline-orientation which is functional for gathering a critical mass of data informing early theoretical development within a new field of research, this kind of orthodoxies are certainly hampering the

further advancement of more mature areas of research. One of many ironies of research is that while it ultimately is dependent on human curiosity, ambition and rigor is often mistaken for conformity, in the worst cases leading to an industrial blue-collar attitude of leaving the head at home, performing work mindlessly and based on instructions. While researchers in applied areas may express their greatest respect for the professions they serve by reflecting upon the possible weaknesses of their own theoretical luggage and methods, the symbiotic relation is often characterized by self-satisfaction from the part of unchallenged researchers, whether we talk about economists, psychologists or engineers. Consequently, stepping into mature fields with new suggestions typically evokes reactions of many kinds, not least concerning scientific methods and their associated worldviews. While the "science wars" of the 1990 (c.f., Parsons, 2003)seem to have ended with an agreement that social construction of scientific facts is not much more surprising than the assertion that we get different data out of different tools and methods of research (c.f., Hacking, 1999; Knorr-Cetina, 1999; Giere and Moffatt, 2003; Latour, 2004), issues of method and its underpinning assumptions often provoke so strong reactions that we may ask with Jersild (1990) whether identity and worldview are really two different things, or rather one single "me in the world", also for researchers.

By now, it should be clear that the motivation for doing this exploration into the issue of diversity in C2 agility lies in *the very character of the topic*. This also means that while keeping an immediate proximity to the traditions of decision-making, this exploration also tries to broadening the scope and leave the door open for alternative views on decision-making as such and how the problem of diversity for C2 agility should be stated. The main motivation for this broad search is a belief in the rationality of *intersubjectivity* at the intersections between different disciplines, traditions and methods. As Gigerenzer (2008) put it concerning different methodologies and their results:

"To determine what laboratory research tells us about the world, we need to check with the outside world, and to determine whether our observations in the world are correct, we need to test them in the laboratory. A good mix is indispensible. Otherwise, we run the danger of growing so obsessed with the zillionth variation on a toy problem that we can no longer say how it relates to the world outside the lab." (Gigerenzer, 2008, p. vi)

Consequently the main motivation for this paper is to test the *relevance* of the formulation of a theoretical research question concerning *the potentials and limits of diversity for C2 agility* by looking at more than one research tradition in the formulation of the problem. This will hopefully lead to a greater amount of rationality as more aspects of the topic may be highlighted through the multiple perspectives provided by the different streams of research. Furhtermore, by addressing some methodological issues in connection with these different traditions, the aim is to challenge tendencies of methodological uniformity and orthodoxy. This also means addressing the Peter Pan syndrome by encouraging a debate upon methodologies and their rationales and underpinnings. In the ambition to reflect three different aspects of research, this paper may remind of Allison's (1971) classical study of the arguments around the decision-making of the Cuban Missile-crisis. However, this exploration extends the view beyond traditional organization theory to relate to later contributions within experimental psychology as well as influences of anthropology upon organization theory.

Hence, this paper should be understood as an attempt towards a topic-oriented research (as opposed to a traditional academic topic-oriented research) to explore how we can understand and explore the limits of diversity in C2 Agility, as well as in C2 research more generally.

In the following three different research traditions will be briefly described and discussed in relation to C2 agility and its issues of cognition, social context and the very character of knowledge, to broaden the theoretical underpinning of C2 research. More specifically the different traditions are presented in terms of their theoretical and methodological backgrounds, not least in relation to decision-making, and what specific perspective they bring on the issue of diversity in C2 agility. Hence, the practical question whether diversity can increase agility in C2 here serves as a starting point for exploring what a more exact formulation of the research question according to the three different research traditions would mean. We thereby scrutinize the different assumptions of the different paradigms and discuss their methodological, epistemological and ontological assumptions respectively, hence hopefully increasing the rationality of choice in the formulation of the more exact research problem. The final discussion may concern to what extent this diversity in research is contributing to a fuller understanding of the challenge of C2 agility and whether the findings can synthesized or must be seen as complementary in the recommendations for future research that would follow from the three research traditions respectively. Hence, in the following the three different traditions will be presented and discussed in relation to diversity in C2 agility. As any classification is to some extent arbitrary, we may discuss the virtues and shortcomings of defining the topic of diversity in C2 agility in terms of the distinctions in the following sections:

- The “biases and heuristics” tradition in experimental psychology has increased our understanding of the mechanisms behind deviances from earlier expectations of rational decision making as stipulated in economics.
- With its roots in anthropology, the “situated cognition” or “distributed cognition” research has a radically different view on methodology and knowledge, emphasizing the need for interpretation to grasp the intelligibility of human action.
- The “classical organization theory”, developed into a genre of its own, heavily emphasizing the negative consequences of bounded rationality expressed in irrational decisions, routines and rules of thumb heavily outweighing attempts of agility.

2. The biases and heuristics paradigm

Background and contributions

What is here called the biases and heuristics paradigm is characterized by its focus on the focus on the *individual* decision maker as level of analysis, its location within *cognitive psychology* as well as its foundation in traditional scientific *experimental* methods. While sharing the interest in cognitive processes with early pioneers of psychology and pedagogy (c.f., James, [1890] 1957; Dewey, [1910] 1998; Piaget, [1936] 1953), later developments of the behaviorism of the early 20th century and the cognitive revolution in the 1960s strived to make psychology an objective science untainted by subjectivism by rejecting introspection and self-reflection both as method and in its view on the human mind (c.f., Kolb and Kolb, 2009). Hence, the positioning of the genre can be described as ontological realism, in its typically implicit assumptions about forces and laws (c.f., Hollis, M. 1994)

and positivism in its view on method and the relation between statements and the world, issues that have become of critical importance in the social sciences (c.f. Alvesson and Sköldberg, 2009).

While positioning itself perhaps closer to natural science rather than other social sciences through its ideals, the genre has made its major contributions in relation to social science in its broadest terms, including economics, and is sometimes referred to as behavioral economics. Nevertheless, the proximity to social sciences is rather shown in its contributions rather than in common theoretical base or methodology. Few researchers have satisfactory knowledge and understanding of the both sides of the chasms between the different genres of economics, social theory and cognitive psychology. Consequently, the comments on the other parties' perspectives, knowledge and methods tend to be blunt and shallow (c.f., Gigerenzer, 2008; Hultkvist, 1993). Nevertheless, despite these distances to other social theories and economics, two prominent representatives of the genre were awarded with the Nobel Prize in Economics –Herbert Simon, in 1978 and David Kahneman, in 2002 – for pioneering work into the decision-making process and integrating psychological research into economic science respectively. Hence, contributions of the biases and heuristics paradigms may be understood in relation to the widespread notions of *economic man*; a perfectly rational and utility-optimizing individual, as well as the application of this idea in organizational settings.

Simon (1955) pointed out that the assumptions of traditional economic theory were far from realistic descriptions of real life decision-making actors: full information, well organized and stable systems of preferences, alternative courses of action and computational skills to calculate which of these alternatives that would render optimized utility. Although debated, his critique has later become known under the notion of *bounded rationality* and Simon's ([1947] 1997) original work was written with the conviction that decision-making processes hold the key to understanding organizations. How the notion of bounded rationality should be understood has been debated (c.f., Gigerenzer, 2008). Nevertheless, in relation to C2 research, the *OODA-loop* (Observation – Orientation – Decision – Action)(c.f., Osinga, 2007) remains the dominant frame of reference for cognition and decision-making and the speed and accuracy of such decision-loops have for a long time been at heart of the understanding of C2, not least in relation to maneuver warfare (c.f., Osinga, 2007). In relation to military research, the biases and heuristics paradigm has become established as a solid basis for C2 research, both in terms of rigorous scientific method and a growing body of knowledge. However, these findings are increasingly subject to debate as how they should be understood: as human shortcomings or efficient adaptation to ill-structured situations.

Important findings

Much of the findings within the biases and heuristics paradigm are still used to argue for the need for improving rationality in human decision-making, as it has been found biased, irrational and thereby inefficient. A typical representative for this genre may be Harvard Business Review's (2011) suggestions to: 1) set up the right context including recruiting the right people; 2) to frame the issue properly; 3) to generate alternatives; 4) evaluate those alternatives and; 5) choose the best alternative, i.e., to achieve a process that would restore the lost faith in an *economic man* type of rationality. Biases are often describes as traps that should be avoided to increase rationality in decisions, such as the traps of *anchoring* (giving disproportionate weight to the first information received), *status-quo* (bias towards alternatives that perpetuate the present state of affairs), *sunk cost* (make choices to justify past invalid choices), *confirming evidence* (seek out information that supports our existing point of view), *framing* (take on a perspective or definition of an issue or

situation, also causing other biases), *overconfidence* (people tend to be overconfident about their own accuracy), *prudence* (overcautiousness when facing high-stakes decisions 'just to be on the safe side'), and *recallability* (forecasting overly influenced by historical dramatic or catastrophic occurrences) (Hammond, et al, 2011).

As many as 60 biases have been identified since the start of the decision bias research in the early 1970s. The pioneers Kahneman and Tversky initiated a research that caught on quickly and the concept of decision biases is now embedded in psychology, economics and business. The findings have also evoked public interest in the issues, generating a popular literature that generally has interpreted the findings as seeing humans as defective decision makers (Klein, 2009), such as *Sway: The Irresistible Pull of Irrational Behavior* (Brafman and Brafman, 2008), *Blind Spots: Why Smart People Do Dumb Things* (Van Hecke, 2007), *Predictably Irrational: The Hidden Forces That Shape Our Decisions* (Ariely, 2008), *Decision Traps: The Ten Barriers to Brilliant Decision Making* (Russo and Shoemaker, 1989), *Everyday Irrationality: How Pseudo-Scientists, Lunatics, and the Rest of Us Systematically Fail to Think Rationally* (Dawes, 2001). In addition, the findings about biases has motivated a literature extending the arguments of rational decision making as to further exploit statistical methods to improve decision making in business (Davenport and Harris, 2007) as well as in private life (Ayres, 2008), i.e., to use quantitative tools and reasoning to restore the rationality of economic man through probability estimates.

There has been a quite intense debate in connection to the ideas about how to tackle bias in decision making, which on a more profound level also includes the very *understanding* of what *bounded rationality* is intended to *mean*, i.e. in different interpretations of Herbert Simon's concept. Kahneman (2011), Klein (2009) and Gigerenzer (2008) agree that the interpretation of bounded rationality as only an *optimization under constraints* strips the very notion of every essential meaning. The economist Milton Friedman explained this understanding of bounded rationality: "The question is not whether people actually optimize, with or without constraints, but whether they *act* as if they were doing so" (p. 80). Hence, this *as-if* notion of bounded rationality in decision making is an important mark of a very specific understanding of how humans make decisions, i.e. exactly the one that will lead writers to publish books with instructions of how to restore the Harvard-like process of rational decisions (here above), although research suggests that this is not the way people get along with the challenges of the practical world.

While research has generated massive evidence of the shortcomings of human decision making, it can also be argued that this partly is a problem constructed by the very methods of laboratory experiments and how the problems were defined: "The limitations in our strategies are easier to demonstrate in a laboratory than in the real world" (Klein, 2009, p. 54f). In relation to their earlier work, Gigerenzer argued that "Kahneman and Tversky see the glass as half-empty, whereas I see it as half-full" (2008, p. 19), suggesting that Herbert Simon applauded their demonstration of systematic deviations from the ideal of economic man, but rather overlooked their tendency to accept as normative the very optimization theories that he fought so fiercely against (p. 86). While this point of reference still persists, later contributions seem to have shifted focus towards more independent arguments for an optimal blend between rational analysis and intuition or more automatic modes of cognition. Hence, Kahneman's (2011) bestseller *Thinking, fast and slow*, as well as Dane and Pratt's (2007) Academy of Management award-winning article *Exploring intuition and its Role in Managerial Decision Making* both drive their arguments from a more independent position, focusing on the

balance between the spontaneous and automatic System 1 and the voluntarily reflective system 2. Hence, slowly the paradigm is leaving the perspective on bounded rationality as *cognitive illusions* (c.f., Gigerenzer, 2008).

The notion of bounded rationality that is suggested to be closest to Herbert Simon's view on heuristics can be called *ecological rationality*. With this view, heuristics also involves determining the environmental structure in which a given heuristic is successful and to design heuristics and/or (physical or social) environments for improving decision making (Gigerenzer, 2004; 2008; Simon, 1990). This marks a more independent perspective in that it "directly analyzes the decision process rather than trying to demonstrate violations of the assumptions underlying as-if models" (p. 90). Hence, the task of determining rationality of decision making is twofold, to determine the heuristic and its fit with the environment, as explained by Simon: "Bounded rationality is like a pair of scissors: The mind is one blade, and the structure of the environment is the other. To understand behavior, one has to look at both, at how they fit. In other words, to evaluate cognitive strategies as rational or irrational, one also needs to analyze the environment because a strategy is rational or irrational only with respect to a particular physical or social environment." (Gigerenzer, p. 86). This also addresses "a deep normative controversy in the cognitive and social sciences, where one view always sees errors as negative, and the other view acknowledges that "good errors" can exist, as they express an adaptation of mental heuristics to the structure of the environment.

This ecological view is also prone to see the situation of decision making as unraveling, as with the example of the baseball player: "[T]he player's goal is not to predict the landing point, but to be where the ball lands. The rationality of heuristics is not simply a means to a given end; the heuristic itself can define what the end is" (Gigerenzer, 2008, p. 89). This also points at a deep normative controversy; whether errors are always negative or can be seen as *good errors* in the case where the limitations enable adaptive behavior as new functions are being enabled through the error. Gigerenzer argued that the first version meant "content-blind norms" which "fail to provide a reasonable general definition of error and are inapt tools for unraveling the laws of the mind" (ibid., p. 78). An evident benefit of cognitive limits is that it allows for relying on small samples for early detection of contingencies, which is beneficial as long as it outweighs the cost of false alarms. Hence, the perspective of ecological rationality may challenge the very notion of rationality through its emphasis on adaptation rather than prediction in static situations of decision making and further research may approach neurology and biology. Gigerenzer concluded: "It lies ahead to discover how much of human cognition can be usefully understood in terms of heuristics … cue orders may have as much to do with costs and accessibility of each cue as with validity." (Gigerenzer, p. 63f).

In similar vein, Klein (2009) emphasized the typical character of real life environments: while most of the research on thinking and decision making takes place in bright and clear conditions, the more typical environment in natural settings may be of the opposite character. The primary interest may be "how we think and decide in the world of shadows, the world of ambiguity" (p.6), pointing at the need to *make sense* of events and *adapting* to ambiguous outcomes: while systematic analysis may be appropriate to tackle well-ordered tasks, it may provide little guidance in complex settings. Emphasize procedure over skills in such setting only sets "a standard for mediocre performance" (ibid. p. 31), rather than rely on a broader repertoire, including *tacit knowledge*, such as perceptual skills, workarounds, judging typicality and mental models. Some direct consequences of this more dynamic perspective has been testing of less analytical planning models, which, e.g., Thunholm

(2005) found to render the same quality more rapidly than purely analytical approaches, as well as Klein's notion of *flexecution*, connecting decision making with adaptive planning.

Perspective on "Diversity in C2 Agility"

As the above presentation illustrates, the biases and heuristics paradigm contains a broad spectrum of understandings of the very notion of *bounded rationality*, which also has direct consequences for what this paradigm would have to say about diversity in C2 agility. With the *as-if* understanding of human decision more information and processing power would probably be of greater value than diversity, whereas the *cognitive illusions* version would rather acknowledge diversity as a possible remedy for human shortcomings. Kahneman (2011) concluded that observers are less cognitively busy and more open for information than actors, as well as organizations are better at avoiding errors than individuals. Implicitly, diversity is deemed beneficial: "more precise gossip at the water cooler" is a promising path to better decisions, as well as "a richer language is essential to the skill of constructive critique" and ultimately, people will make better decision if they "trust their critics to be sophisticated and fair" (p. 417f). With the view of *ecological rationality*, diversity may not even be necessary, as errors aren't necessarily negative in the long run and through its emphasis on the fit between the heuristic and the environment, diversity may even complicate at least the social part of the environment. As cost and accessibility may influence decision makers as much as validity does and the typical situation is one of uncertainty and ambiguity, adaptive behavior may be more important than multiple perspectives, at the same time as ambiguity itself opens for different ways to make sense of the situation.

As shown, the biases and heuristics paradigm is indecisive about the role and limits of diversity in C2 Agility and leaves many questions open for future studies. Nevertheless, later drifts of the genre into matters of ecological adaptation and flexible planning shows an almost perfect fit with the issue of C2 Agility. As the broadening of the topic to emphasize real world situations rather than only experimental settings has shed new light on the challenges, the paradigm seems to get closer to problems of practical relevance for decision makers. However, asking questions about the fit between the heuristics and the environment, the content of good errors, and the ways decision makers make sense of ambiguous situations opens up for fundamental questioning about the very notion of *rationality* and by which *methods* it can be studied, in terms of both blades of the 'pair of scissors'. Hence, the bias and heuristics paradigm can be used to argue both for the richness of diversity and for its overestimated value.

3. The situated and distributed cognition paradigm

Background and contributions

The paradigm of *situated and distributed cognition* has attracted increased attention during the last decades (Elsbach, et al., 2005), not least through its connection with notions of *sensemaking* (Weick, 1995), issues of *knowledge management* (Blacker, 1995; Blackler and Reagan, 2009) and the fierce debates sometimes called the *science wars* (Parsons, 2003). It extends the arguments of Simon's *ecological rationality* of heuristics. As Weick argues, sensemaking invokes both a realist ontology (that there is something out there to be sensed accurately) and at the same time an idealist ontology (suggesting that the 'something out there' needs to be agreed upon and constructed plausibly), where the former is typically nice to have, but secondary in typical managerial thinking. Rather than correctness, sensemaking is about plausibility, pragmatics, reasonableness, invention, and

instrumentality. The *commitment to act* focuses attention and provides the frame within which cues are extracted and interpreted according to the action repertoire behind the framing, implying what can be known or not (Weick, 1995). Sensemaking is about *contextual rationality* in which action repertoires, practical tools and role structures interact to create meaning, identity and perception. Hence, you may need to "drop your tools" to be able to adapt (Weick, 2001, p. 107).

The paradigm raises questions about the relevant *level* or *unit of analysis* for human cognition. With Simon's scissor-metaphor, it suggests that the environment play an as important role for cognition as what goes on inside peoples' heads. Also, cognition that is situated in practical, physical and social structures will also affect the very *character of knowledge*, revealing the paradigm's legacy from the genre of sociology of knowledge and the very debate around scientific paradigms. With its extreme empiricism and detail in methodology, ethnographic studies serves as a characteristic example of this paradigm with a phenomenology that avoids taking anything for granted and instead accepting what is observed as it is, assuming that what people do must make sense, at least to themselves. However, the interest in the sociology of knowledge and of science can be identified also among early sociologists such as Marx, Durkheim and Merton, with a renewal through Kuhn's work on scientific paradigms (c.f., Rigné, 1998).

A contribution of more recent date has been the debate around the character of scientific knowledge which escalated to what has been called *the science war* (Parsons, 2003) mainly turning around the challenging thought not least introduced through Latour and Woolgar's ([1979] 1986) study of *Laboratory life*, in which scientific work was described and explained in detail as a not only technical and practical, but also a social process of establishing scientific facts. Hence, at heart of the following debate between "positivists" and "constructionists" was the two rivaling ideas that science either relies on objective facts that bring about truth (or something close to it), or that science is just another human activity and that its outcomes in terms of "facts" or "proofs" will always be tied to the practical and cultural of the people who made the findings. The Sokal-affair marks a peak in the conflict (c.f., Sokal, 1996, a; b). Later contributions have tried to nuance notions of *social construction* (Hacking, 1999), the artificial trenches between cognitive and social approaches to knowledge (Giere and Moffatt, 2003) and the need also for constructionists to get further from *matters of fact to matters of concern* (Latour, 2004). Hence, extreme positions increasingly look outdated as e.g. the front figure of the post-modern side Bruno Latour clams to be an empiricist only trying not to be too naïve, but on the other hand address issues of societal relevance (ibid.).

Important findings

A characteristic mark of this paradigm is the extremely detailed empirical methodology inherited from the anthropological tradition. In order to understand how people experience their realities, what meaning they assign to things and events, and what tools, instruments and artifacts that are playing important roles in apparently mundane everyday doings, the investigation must start with an ambitious inventory of those everyday doings and all practical things involved in the accomplishment of different tasks. First thereafter, the researcher may start trying to understand what roles all practical doings, artifacts and interactions play in the construction of meaning, i.e., the sensemaking, that make up the actors' worlds, and hence also their cognition. A good example of such an inventory is found in Hutchin's (1995) minor classic *Cognition in the wild*, in which he describes and compares in detail the art of navigation, from both a Western and a Micronesian viewpoint. In doing so, his examination bridges the disciplines of cognitive psychology and anthropology and brings light on the

often ignored cultural aspect of cognition. The most important precondition for such findings is to approach cognition in its situated practices outside the laboratory – in the wild.

Navigation can be seen as computation. Earth is represented by the chart with coordinates as the primary frame of reference. Direction, position, and distance are established through angular measurement, combined with a universal time standard to estimate speed, all represented by numbers. Models of the course are marked as line-of-position constraints on the chart and distance, rate and time are numerically represented and computed through analog-to-digital conversion, digital manipulation, and digital-to-analog conversion in the plotting of results on the chart. Also Micronesian navigators perform computations determining positions through intersections of one-dimensional constraints. For over thousands years, they have routinely embarked on ocean voyages that take them several days out of the sight of land, without hi-tech devices. While at a first glance, their technique may seem inadequate, western researchers have found that these navigators at any time can accurately indicate the bearings of the port of departure, the destination and other islands off the side of the course, even though all of them may be over the horizon and out of sight.

The world of the Micronesian navigator is full of indications about positions, but one of the most widespread notions is the concept of *star path* or linear constellation, is a set of stars that follow the same path, i.e., they all rise in succession from the same point on the eastern horizon. They typically consist of six to ten stars fairly evenly spaced across the heaven. Together, they make up a "connect-the-dots" drawing, making an arc across the sky. While the stars themselves wander across the night sky, the arcs or linear constellations, the *star paths* remain stationary. The seeing of the night sky *in terms of* linear constellations is a *representational artifice*. Its function is to *convert the moving filed of stars into a fixed frame of reference*. This is not a passive perceptual process, but a *projection* of external structure (the stars) and internal structure (the patterns) onto a *single spatial image*. The superimposition of external and internal makes the external structure culturally *meaningful* in that it establishes relations to one another. Hence, the process of perception necessary for navigation is *actively constructive*. This principle is the same also in the more non-professional seeing of star constellations generally. Anybody who can recognize also the Western constellations of stars knows that the subjective experience of seeing the constellation is not just the stars, but the constellations themselves seem to be "out there": one can almost see the small little lines holding the stars together in the sky.

While the Micronesian navigator holds all his knowledge required for the voyage in his head, Western traditions have emerged not least through the development of physical artifacts which have become repositories of knowledge, often representing more than any individual could know. Through the combination and superimposition of task-relevant structure, artifacts came to embody knowledge that would be too demanding to represent mentally. Many of the instruments of Western navigation principally mean building computational constraints of the task into the physical structure of the artifact. Hence in addition to the mental structures demanded for skilled navigation, Western navigation chrystallized knowledge and practice in the physical structure of artifacts, developed measurement as analog-to-digital conversion, increasingly relied on technologies of arithmetical computation and developed the chart as the fundamental model of the world on which the plotted course became the principal computational metaphor for the voyage. Over time, these artifacts have become taken for granted.

An important feature of practical navigation is the precomputations that redistribute cognitive workload over time. Stacking charts on the table in the order in which they will be needed is a simple but central example of such redistribution of effort across time. Many of the elements of preparation not only redistribute the tasks, but also create new structures that change the cognitive nature of the tasks. Pre-plotted entry tracks, tide graphs, turn bearings, and danger ranges become elements in a functional system of precomputations that not only doing things ahead of time but also make the task easier to do. Even the chart itself can be seen as a structure that is constructed ahead of time and changes the nature of the computation that is has to be done in the high-tempo activities of practical navigation. It establishes a general framework onto which specific observations that are local in time and space are projected. In this sense, the Micronesian star-path's are filling exactly the same function. The precomputations is a way of building local invariants into the structure of the tools: where the structure in the world is invariant the computations can be made more efficient by building representations of the invariants into the representations of the world. The precomputations are expressions of modularity in that it removes from local computations any aspects that are invariant across the spatial and temporal extent of the computation.

Precomputations can be seen as windows of a cultural process. The computation are based on the projection of the dead-reckoning position, made tens of seconds ago; tide graphs constructed a few hours ago; changes to the chart that was plotted a few days ago; on the projected track and turn bearings made a few weeks ago; on the changes in the last version of the chart issue a few years ago; on the plotting tools designed a few decades ago; on the mathematics of the projection of the chart which was worked out a few centuries ago; on the organization of the numeric system which was developed a few millennia ago. While it may seem exaggerated to track moments of navigation to its earliest roots, it nevertheless highlights that even the most mundane aspects of handling the practical challenges of everyday life are colored by the cumulative process of building knowledge into the practical tools of navigation, which in turn decides what things that are easy or difficult to do. The point becomes even clearer when comparing different traditions of navigation. The system of navigation is part of a *cognitive ecology* in which different representational technologies constitute one another's functional environment and the details of respective technology present certain opportunities for error by precluding others.

In explaining the importance of the environment for cognition, Hutchins (1995) referred to Simon's (1981) metaphor of the intelligence of ants, whose complicated movements on the beach may induce ideas about some complicated program for constructing the path taken. However, as Simon put it, that trajectory tells us more about the beach than about the ant. Generations of ants have left their marks on the beach and now dumb ants appear smart through its interaction with the residua of the history of its ancestors' actions. In similar ways, watching people in the wild may tell us more about their environment for thinking than about what is inside them. Furthermore, as much of the physical context is shaped by human activity, the environments of human thinking are not "natural", but rather artificial: "Humans create their cognitive powers by creating environments in which they exercise those powers" (p. 169). While navigation may be seen as computation, practical navigation involves very few arithmetic tasks. Instead, the functional system that performs the task is a constellation of structured representations that are coordinated by pattern matching, by a simple manipulation of physical objects. Herein lies an enormous potential of error by the introduction of modern technologies: "By failing to understand the source of the computational power in our

interaction with simple 'unitelligent' physical devices, we position ourselves well to squander opportunities with so-called intelligent computers" (p. 171).

Perspective on "Diversity in C2 Agility"

In addition to the centrality of artifacts for human (cultural) cognition, there is hardly a more important concept in anthropology than *division of labor*. Social organization allows for results that could not have been produced by any individual alone. In modern society, this principle is so ubiquitous and taken for granted that it has become largely invisible. There is a direct effect of division of labor on cognition in that the cognitive task is divided on two kinds of cognitive labor: the one that is the task and one that governs the coordination of the elements of that task. Hence, a group of humans may have cognitive properties that differ from the cognitive properties of any individual. In other word, the *division of cognitive labor* becomes a key concept. Organizing navigation thus not only contains the precalculation and distribution of task over time and space, but also assigning these tasks to different individuals who need to interact with their specialist cognition which is distributed over the environment not least through the use of artifacts for the cognitive task. Hence, *organizing means first generating and then dealing with diversity*.

From this perspective, diversity is a fundamental consequence of organizing, and its potential disadvantages may be well known: the poor integration of operations. As diversity generates a multitude of perspectives given the expertise of specialized laborers respectively, as much as it may lead to a richer understanding it may also lead to endless disputes about the properties of reality. In some environments, such chronic indecision may be much less adaptive than some level of erroneous commitment, which may be *the fundamental tradeoff in cognitive ecology*. The social organization, i.e., the *distribution of power to define situations as real*, determines the characteristics of the organization: a more horizontal structure leaves more room for expressing diversity but may increase the potential for indecision, while a more centralized system may generate confirmation biases. In organizations which need both exploration of an interpretation space and consensus of interpretation, typically have two modes of operation: one that favors diversity and one that breaks the isolation of the participants and exposes the interpretations to disconfirming evidence. While the balancing of these tradeoffs is not an easy task, Hutchins (1995) concludes: "Doing without a social organization of distributed cognition is not an option." (p. 262)

4. The classical organization theory paradigm

Background and contributions

Modern organization science took off after world war 2. While indeed earlier contributions such as Taylor's view of management was called "scientific" and typical tools such as measurements and statistics were used for managerial purposes, the writings of the early pioneers still contain a basically pragmatic attitude, judging theories in terms of their usefulness. Simon ([1947] 1997) saw his original work as a second generation of modern organizational studies, after the pioneering works of Taylor et al. As such, the now classical scientific strand of organization studies is based on the same pioneering work of Simon as the bias and heuristics paradigm presented here above. Central to Simon's contribution to organization studies were the findings that later came to be recognized as *bounded rationality*. In organization studies, this notion evoked a deep divide between different strands of research and scholars, and in some cases between researchers and practitioners, an *intellectual schizophrenia* (Cohen and Sproull, 1991) which is still dominating the field until this day,

not least in the area of management control (Den Herzog and Roberts, 1992; Bjurström, 2007), rigorous models with rationalistic assumptions and substantial empirical work denying those assumptions, manly with a negative theme, not proposing any alternatives for practitioners. Hence, while Simon's contribution were the starting point of the genre, his findings were typically ignored, interpreted in the *as-if* version of economists, or taken as *cognitive illusions* and signs of irrationality.

Besides the more academic literature, there is also an abundant popular management, typically making very general claims based on anecdotal evidence. In the more academic and skeptical tradition of management studies, a basic character of any introductory textbook is the presentation of a range of *perspectives* on organizations, marking the intense albeit somewhat introvert reflections upon the subject that has characterized organization studies since the 1970s. This movement away from rationalistic models and tools for refining the details of decision making through systems and calculations had many different sources of inspiration, ranging from the notion of bounded rationality to more value-based criticism against managerialism, but also a reflection upon the possibilities and scope of social sciences more generally. Czarniawska (2004) concluded that the failure of social science to predict human behavior as its greatest achievement, as it thereby shed light on the very *intelligibility* of human action through its sense of purpose. Hence, sensemaking in the face of ambiguity has developed to not only be a matter of the objects of study, but also for organizational scientists themselves, hence increasingly having a qualitative orientation to try to *understand* processes of organizing (Weick, 2001), rather than predicting behavior or prescribing static, efficient organizational design.

An expression of this multiple sensemaking is the notion of *view of the firm*, indicating the specific assumptions behind any theory concerning the basic question what an organization *is* at all. In similar vein, a lot of energy has been invested in scrutinizing taken for granted notions of decision making, the meaning of strategy, the concept of the market, assumptions of individual action, the claims of representation in measurement, etc. As such questionings have broadened the focus of interest and researchers actively have tried to evoke new understandings of organizational life to test the validity of both old and new concepts, the theoretical basis has also been broadened by including influences not least from psychology, social psychology and sociology. While this has meant theoretical progress, complaints are frequently raised even from high-ranked academics, about the lacking communication between different researchers themselves as well as with practitioners.

Important findings

It is characteristic of the field that the last edition of *Handbook of Decision Making* (Nutt and Wilson, 2010) starts with an inventory of different theoretical perspectives, and ends with a discussion about the possibility to create a unified theory of decision making. Hence, the mark of the paradigm is not so much a specific theoretical tradition in itself, as the empirical phenomenon of decision making around which different theories and methodologies are applied and the editors conclude that "Summing up presents a challenge, especially when the subject matter deals with many divergent views and conflicting opinions" (Ibid. p.645). Furthermore, integration attempts have been troubled with incompatibility among ideas and the incremental efforts of the past haven't provided a gradual accumulation of knowledge indicating *how decision should be made*, resulting in a lack of studies empirically testing prescriptions that would offer practitioners anything resembling an action plan for decision making. Decision making tends to be treated as a structure or as a process, but seldom as both and there is generally a reluctance to deal with process. Generalizations are made about

process in terms of the political nature of decision making or its degree of rationality, but not as actions steps. Although theories abound in the literature, it is often either missing or treated implicitly in much of the research. Theories are rarely used in attempts to identify and test competing theories or to use them to model action steps in a process. Furthermore, many studies have a vague purpose, resulting in difficulties to identify them as descriptive or prescriptive.

While decision making is so central that March and Simon (1958) saw it as virtually synonymous to managing organizations, a basic assumption of this paradigm is that decision making is about more than computations carried out to make judgments and choices: both the organizing of decision activity as collective phenomena and the cognitive processes of individual decision makers take centre stage. For instance, rigorous mathematical models of risk, options, game theory and choice may highlight some aspects, but are nevertheless of little value when considering how people in organizations make decisions. Decision making is often treated as an instantaneous choice between different alternatives in a 'point of decision'-approach. This view is however unable to see the richness and complexity of the process that led to the generation of alternatives and defined the very point in time where the decision was to be made. In real life, it is more likely that the decision maker has less discretion about what decisions that can be made, where and when. Hence, organization theorists have emphasized that processes in organizations are as much about defining the question as they are about providing an answer. Decisions may be as much about making a *plan* as a *ploy* or an emergent *pattern* without much intention behind it. It can be seen as achieving a *position* as well as achieving and reflecting a *perspective* in that the definition and solution of problems reveal the worldview of the decision maker (c.f., Mintzberg, 1987).

There have been radical changes in how decision making has been studied over the years: from the focus on tools from a planning perspectives in the 1950s and 1960s, over discussions about pay-offs between different utilities in decision making in the 1970s, to a move away from examining the content of strategic decisions to instead examining the process in the 1980s and on. Recent approaches have focused on the micro aspects about how managers perceive the situation, how they act, think and interpret strategic decisions. This approach has been termed the *practice turn*, emphasizing decision making as an ongoing practice rather than isolated moments of choice, also implying the dual influence of societal structures, expectations, rules, habits, etc, on the one hand and the human capacity for analysis and self-reflection on the other hand. This perspective has also showed how day-to-day interaction s between managers are imbued with the context of administrative and organizational procedures, which all influence decision making over time and makes it inherently difficult to distinguish when strategic decision making activity is taking place and not (Nutt and Wilson, 2010).

Nutt and Wilson (2010) made three important suggestions to advance future research into decision making. First and most importantly, there is a need to emphasize decision making a process in terms of action steps and generate empirically defensible documentation of such steps. Secondly, there is a need to fashion an em empirically grounded set of prescriptions that indicate how to make decisions that have a better chance of success. In this process, behavior is but one element of an action theory. Finally, there is a need of codifying decision outcomes and outside influences, remembering that decisions yield multiple outcomes and become the basis for future decision activities. Taken together, this would mean a move away from theory-driven efforts, toward studies where the researcher searchers for productive behavior and useful tools, i.e. making a reorientation from

explanatory to exploratory efforts that seek to inform practice a list of what works, what does not, and why. Studies of process caricatures fail to explain *how* decision makers conduct analysis, form coalitions, engage flexibly or promote adaptability. Hence, first of all, there is a need for studies of what decision makers *do*, to uncover the practices of master decision makers, including the influence of situational factors, and to model decision making to explore systematically the merits of tools and techniques. Such a research will require an integration of findings, informing a research that is focused on providing something of value to practice.

One such attempt to integrate earlier findings was made by Ocasio (1997), suggesting a *attention-based view of the firm*. Ocasio's aim was to rediscover the central importance of the structuring of attention in Simon's ([1947]1997) work on administrative behavior, arguing that the concept of attention with its long history in organization theory had failed to develop into a unified perspective on organizational behavior. Instead, he meant that theories of attention had moved away from Simon's dual emphasis on structure and cognition in favor for emphasizing either how attention is shaped by routine and bounded rationality (March and Simon, 1958; Cyert and March, 1963), or alternatively, how becomes loosely coupled in processes of enactment (Weick, 1979) and organized anarchy (Cohen, et al, 1972). Instead, Ocasio sought to re-establish Simon's view on firm behavior as both a cognitive and a structural process, as decision making in organizations is the result of both the limited attentional capacity of humans and the structural influences of an organization on individuals' attention and thereby also decision making. In his suggestion of seeing organizations as *systems of distributed attention*, he also approached other traditions of situated or distributed cognition, e.g. with reference to Hutchins' (1995) anthropological work he also made an attempt to bridge the chasm between cognitive and social views, thus aiming at a topic-orientation rather than a discipline-orientation. However, the cognitive heritage clearly dominated the framework.

Other contributions have emphasized the social character of both behavior and even cognition itself. Seeing decision making as *practice* extends the notion ecological rationality to embrace not only what goes on in the head, but also the entire bundle of practical and social arrangements influencing behavior, which becomes intertwined with processes of cognition (c.f., Whittington, 2006; Schatzski, 2005). This multidimensional view also open up for multiple functions of different aspects or steps in the decision making process. Formal structure, analytical tools and formal decision making processes may well be celebrations of rationality as myth and ceremony as much as practices of more concrete usefulness (c.f. Meyer and Rowan, 1977). Such findings should however not downplay the possible symbolic usefulness of such arrangements. Czarniawska (2004) argued that in order to understand human *intelligibility*, we cannot exclude the social influences on cognition. As potential exclusion is an immediate threat to any social being, there is a basic need for any individual to be able to account for their actions in a way that legitimizes their respected role in a group. In consequence, humans narrate experiences, making real time stories about their course of action which also provides sense and purpose to guide their path. Hence, a *narrative mode of cognition* complements and guides even the selection of stimuli by suggesting what is relevant and not in regard to what need s to be accounted for in any social setting.

Perspective on "Diversity in C2 Agility"

Given the broad diversity of organizational studies, it seems difficult to sum up a single view on diversity. In general, the views on diversity in organizational research can be said to follow the distinction between *as-if* assumptions, *cognitive illusions* or *ecological rationality* as discussed earlier.

If nothing else, the diversity of the field suggests that especially complex issues like organizing and organizations may deserve a broader spectrum of perspectives to be accounted for. Nutt and Wilson (2010) commented upon the fact that many organizational researchers view diversity as positive. That might imply a tendency towards the *cognitive illusions view* of bounded rationality. However, the diversity also seems to hamper further advancement in the field, especially in combination with the much documented disinterest in practical consequences of theories. While this may be seen as an ordinary division of labor between experts in different lines of research and different practices the integrative aspect seems underdeveloped, possibly driven by the tendency towards discipline-oriented, theory-driven research and methodological uniformity within each such line of research. Hence, the possible benefits of diversity for the sake of enriching the understanding of complex phenomena doesn't seem to materialize, neither in theory nor in practice.

At the same time as diversity may illustrate the need even for researchers to engage in sensemaking activities, it also highlights the same tendencies as in analyses of ecological rationality in other practices: as long as it works and environments don't force actors to change, they will go on by applying their rules of thumb in an everyday business-as-usual manner in their academic tribes (c.f. Adams, 1976). Despite these tendencies, there are also more peripheral lines of research illustrating an alternative way of combining theoretical traditions into practical process tools for generating concrete practical usefulness for practitioners (c.f . Eden and Ackerman, 2010).

5. Limits to diversity in C2 Agility research?

The purpose of this paper was to explore the limits to diversity in C2 agility research. This became a holistic topic as it both concerns how decision making should be organized to improve agility in C2, at the same time as it addresses what scholarly disciplines, genres and paradigms that may be involved in such an exploration of how to develop a better responsiveness in decision making. As the presentations of the three different research traditions have shown, in order to answer the question about *the limits of diversity in C2 Agility*, we may first need to confront the ambiguities in the concepts of decision making, cognition, rationality, organizing and thereby also C2 itself in order to even formulate the problem in a theoretically informed way.

This may be seen as a weakness of the research community itself, since – despite partial convergence – few efforts seem to be made to synthesize findings or deliver any actionable output from researchers to practitioners. This in turn may not be a problem of diversity itself, as it is a problem of theory-driven, discipline-oriented research in different traditions and directions, that never take the risk of exposing own assumptions and results neither to other scholars, nor to practitioners. Hence, the bigger problem may be the introvert orientation which lies behind the notion of *academic tribes* (Adams, 1976), basically suggesting that academics work like anybody else: in their communities, with mindsets and foci formed by the possibilities and constraints given by their local contexts, which are mainly changed through external pressures rather than internal ambition to strive for increased rationality. Consequently, research becomes reduced to the application of scientific theory and methods as thoughtless standard operating procedures and rules of thumb. Hence, Hillman's (2009) simple suggestion to talk more to each other may not be all that easy in practice. The big question is whether such an ambition can be expected to grow from inside local research communities, or if it only will change e.g., through pressure from practitioners or funding institutions.

A often mentioned challenge to cross-fertilization are the tendencies of methodological orthodoxy. A more topic-oriented research would automatically lead to greater pluralism in research methods, as research questions would need to fit phenomena rather than theories. The methodological uniformity, resulting in zillions of studies of toy problems can be found almost everywhere. For instance, the very final words of the latest edition of the Handbook of Decision Making lament these tendencies within organization science:

"[T]he proposed research stream moves decision making research from emphasizing rigor to the point that relevance has been dismissed to a more healthy balance between rigor and relevance" (Nutt and Wilson, 2010, p. 675).

Sadly enough, this only echoes Simon's (1990) complaints about similar tendencies within psychology, suggesting that cognitive and social psychology should be brought much closer together than they have been in the past:

"Psychology does not much resemble classical mechanics, nor should it aim to do so. Its laws are, and will be, limited in range and generality will be mainly qualitative. Its invariants are and will be of the kinds that are appropriate in adaptive systems. Its success must be measured not by how closely it resembles physics but by how well it describes and explains human behavior." (Simon, 1990, p.2).

There should by now be little doubt about the shortcomings of discipline orientation and its expression in methodological uniformity, as it can be expected to lead to lower levels of rationality in C2 Agility research. A topic orientation able to cross the borders of academic tribes could instead lead to increased rationality. However, this logic has its limits: where the environment is complex enough, apparently less rational and more intuitive or limited action repertoires may be as rational as extensive analysis and calculation where no such answers can be found. In such cases, even research must be seen as rudimental expressions of sensemaking. That would finally leave researchers with the moral question of whether it is defendable not to explore the limits of analysis for the sake of agility in C2 research.

References

Adams, H. (1976), *Academic Tribes*, Liveright publishing.

Alberts, D.S. (2011), *The Agility Advantage: A Survival Guide for Complex Enterprises and Endeavors*, U.S. Department of Defense, Command and Control Research Program.

Allison, G. (1971) *The essence of decision-making: Explaining the Cuban missile crisis,* 1 ed,. Little Brown.

Alvesson, M. and Sköldberg, K. (2009), *Reflexive Methodology: New Vistas for Qualitative Research* (2nd ed.), SAGE, Los Angeles.

Ariely, D. (2008), *Predicably Irrational: The Hidden Forces That Shape Our Decisions*, Harper-Collins.

Asplund, J. (1970), *Om undran inför samhället*, (On wondering at society [in Swedish])Argos, Uppsala.

Ayres, I. (2008), *Super Crunchers: How Anything Can Be Predicted*, John Murray Publishers, London.

Baisini, C., Bjurström, E., Gemeinhardt, D. and Nyce J.D. (2011), "Incorporating Contextual Sensitivity and Meta-Cognition into Intelligence and Law Enforcement Training", in Bringuel, A.J., Janowicz, J.C., Valida, A.C. and Reid, E.F. (Eds.) *Terrorism Research & Analysis Project (TRAP): A Collection of Research Ideas, Thoughts, and Perspectives, Vol. 1*, Federal Bureau of Investigation, U.S. Department of Justice, Washington, pp.73-110.

Bjurström, E. (2007), "Creating New Attention in Management Control", Department of Business Studies, *Doctoral thesis / Företagsekonomiska institutionen, Uppsala universitet*, ISSN 1103-8454; 12 http://www.diva-portal.org/smash/record.jsf?searchId=1&pid=diva2:170777&rvn=3

Bjurström, E. (2011), "Hybridization as a Key Challenge to Established Categories, Perceptions and Rules of Engagement in Modern Warfare", in Schröfl, J., Rajaee, B.M. and Muhr, D. (Eds.) *Hybrid and Cyber War as Consequences of the Asymmetry*, Peter Lang, Frankfurt am Main, pp. 41-56.

Blacker, F. (1995), Knowledge, Knowledge Work and Organization: An Overview and Interpretation, *Organization Studies*, Vol. 16, No. 6. Pp. 1021-1046.

Blackler, F. and Reagan, S. (2009), Intentionality, Agency, Change: Practice Theory and Management; *Management Learning*, Vol. 40, No. 2, pp. 161-176.

Brafman, O. and Brafman, R. (2008), *Sway: The Irresistible Pull of Irrational Behavior*, Doubleday.

Cyert, R.M. and March, J.G. (1963), *A Behavioral Theory of the Firm*, Prentice-Hall.

Cohen, M.D., March, J.G. and Olsen, J.P. (1972), "A Garbage Can Model of Organizational Choice", *Administrative Science Quarterly*, Vol. 17, pp. 1-25.

Cohen, M.D. and Sproull, L.S. (1991) "Editors introduction", Special issue: Organizational Learning, *Organization Science*, Vol. 2, No. 1.

Czarniawska, B. (2004) Narratives in Social Science Research, Sage, London.

Dane, E. and Pratt, M.G. (2007), "Exploring Intuition and Its Role in Managerial Decision Making", *Academy of Management Review*, Vol. 32, No. 1, pp. 33-54.

Davenport, T.H. and Harris, J.G. (2007), *Competing on Analytics: The New Science of Winning*, Harvard Business School Press, Boston, MA.

Dawes, R. (2001) *Everyday Irrationality: How Pseudo-Scientists, Lunatics, and the Rest of Us Systematically Fail to Think Rationally*, Westview.

Den Herzog, F. and Roberts, H. (1992) "Learning strategies for management accounting

in unprogrammable contexts", Accounting, Management & Information Technologies, Vol. 2, No. 3, pp. 165-182.

Dewey, J. ([1910] 1998), How we think, Dover Publications Inc., New York.

Eden, C. and Ackerman, F. (2010), "Decision Making in Groups: Theory and Practice", in Nutt, P.C. and Wilson, D.C. (Eds.), *Handbook of Decision Making*, Wiley, pp. 231-272.

Elsbach, K.D., Barr, P.S. and Hargadon, A.B. (2005) , "Identifying Situated Cognition in Organizations", *Organization Science*, Vol. 16, No. 4, pp. 422-433.

Gigerenzer, G. (2004), "Striking a Blow for Sanity in Theories of Rationality", in Augier, M. and March, J.G. (Eds.), *Models of a Man: Essays in Memory of Herbert A. Simon*, pp. 389-409, MIT press, Cambridge, MA.

Gigerenzer, G. (2008), *Rationality for Mortals: How People Cope with Uncertainty*, Oxford University Press.

Giere, R.N. and Moffatt, B. (2003), "Distributed Cognition: Where the Cognitive and the Social Merge", *Social Studies of Science*, Vol. 22, No. 2 (April), pp. 301-310.

Hacking, I. (1999), *The Social Construction of What?*, Harvard University Press, Cambridge, MA.

Harvard Business Review (2011) *Decision Making: 5 Steps to Better Results*, Harvard Business School Press, Boston, MA.

Hammond, J.S., Keeney, R.L. and Raiffa, H. (2011) "The Hidden Traps in Decision Making", in Harvard Business Review, *Making Smart Decisions: Expert Advice on Decision Making from Harvard Business Review*, Harvard Business Review Press, Boston, MA.

Hillman, A. (2009), "Editors comment", *Academy of Management Review*, Vol. 34, No. 1, pp. 7-10.

Hultkvist, J. (1993) *Tvivlet på nationalekonomin: Fyra ekonomer diskuterar vetenskapen och verkligheten* (The doubt in economics: Four economists discuss science and reality [in Swedish]), Forskningsrådsnämnden, (Vetenskapsrådet) Stockholm.

Hollis, M. (1994), *The Philosophy of Social Science*, Cambridge University Press, Cambridge.

James, W. ([1890] 1957), *The Principles of Psychology* (2 vols.), Henry Holt, New York.

Jersild, P.C. (1990), *Humpty-Dumptys Fall: En Livsåskådningsbok* ("Humpty-Dumptys fall,[in Swedish), Bonniers, Stockholm.

Kahneman, D. (2011), *Thinking, Fast and Slow*, Penguin Books, London.

Klein, G. (2007), "Flexecution as a Paradigm for Replanning, Part 1," *IEEE Intelligent Systems*, vol. 22, no. 5, pp. 79-83, Sep./Oct., doi:10.1109/MIS.2007.86

Klein, G. (2008), *Streetlights and Shadows: Searching the Keys to Adaptive Decision Making*, The MIT Press, Cambridge, MA.

Knorr-Cetina, K. (1999), *Epistemic cultures: How the sciences make knowledge*, Harvard University Press, Cambridge.

Kolb, A.Y. and Kolb, D.A. (2009), "The Learning Way: Meta-cognitive Aspects of Experiential Lerning", *Simulation and Gaming*, Vol. 40, No. 3, pp. 297-327.

Latour, B. (2004), "Why has critique run out of steam? From matters of fact to matters of concern", *Critical Inquiry*, Vol. 30, No. 2, pp. 225-248.

Latour, B. and Woolgar, S. ([1979] 1986) *Laboratory Life: The Construction of Scientific Facts*, Princeton University Press, Princeton, N.J.

March, J.G. and Simon, H.A. (1958), *Organizations*, McGraw-Hill.

Meyer, J.W. and Rowan, B. (1977), "Institutionalized Organizations: Formal Structure as Myth and Ceremony", *The American Journal of Sociology*, Vol. 83, No. 2, pp. 340-363.

Mintzberg, H. (1987), "The Strategy Concept I: Five Ps for Strategy", *California Management Review*, Fall, pp. 11-24.

Monod. E. and Boland, R.J. (2007), “Editorial: Special Issue on Philosophy and Epistemology: A ‘Peter Pan Syndrome’?”, *Information Systems Journal*, Vol. 17, pp. 133-141.

Nutt, P.C. and Wilson, D.C. (2010), *Handbook of Decision Making*, Wiley.

Osinga, F.P.B. (2007), *Science, Strategy and War: The Strategic Theory of John Boyd*¸ Routledge, London.

Parsons, K. (Ed.) (2003), *The Science Wars: Debating Scientific Knowledge and Technology*, Prometheus Books, New York.

Piaget, J. ([1936] 1953), *Origins of intelligence in the child*, London: Routledge & Kegan Paul.

Rigné, E.M. (1998) “Kunskaps och vetenskapssociologi” (”Sociology of knowledge and science” [*in Swedish*]), in Månsson, P. (Ed.) *Moderna Samhällsteorier*, Rabén Prisma.

Russo, J. and Shoemaker, P. (1989), *Decision Traps: The Ten Barriers to Brilliant Decision-Making and How to Overcome* Them, Doubleday.

Schatzki T.R. (2005) “The sites of organizations”, Organization Studies, Vol. 26, No. 3, pp. 465-484.

Schön, D. (1983), *The Reflective Practitioner – How Professionals Think in Action*, Ashgate, Aldershot.

Seidl, D. (1997), “The dark side of knowledge”, *E:CO*, Vol. 9, No. 3, pp. 16-29.

Simon, H. (1955), “A Behavioral Model of Rational Choice”, *The Quarterly Journal of Economics*, Vol. 69, No. 1, pp. 99-118.

Simon, H. ([1947] 1997), *Administrative Behavior*, The Free Press, New York.

Simon, H. (1981), *The Sciences of the Artificial*, The MIT press.

Simon, H.A. (1990), “Invariants of Human Behavior”, *Annual Review of Psychology*, Vol. 41, pp. 1-19.

Sokal, A.D. (1996 a) "Transgressing the Boundaries - Toward a Transformative Hermeneutics of Quantum Gravity," *Social Text*, Vol. 46/47, pp. 217-252.

Sokal, A.D. (1996 b) "A Physicist Experiments with Cultural Studies," *Lingua Franca*, May/June, pp. 62-64.

Thunholm, P. (2005) Planning Under Time Pressure: An Attempt Toward a Prescriptive Model of Military Decision Making, In *How Professionals Make Decisions*, Montomery, H., Lipshitz, R. and Brehmer, B. (Eds.), Erlbaum.

Van Hecke, M. (2007), *Blind Spots: Why Smart People Do Dumb Things*, Prometheus.

Weick, K.E. (1979), *The Social Psychology of Organizing*, Random House.

Weick, K.E. (1995), *Sensemaking in Organizations*, SAGE, Thousand Oaks.

Weick, K.E. (2001), Making Sense of the Organization, Blackwell Publishers, Oxford.

Whittington, R. (2006) “Completing the practice turn in strategy research”, Organization Studies, Vol. 27, No. 5, pp. 613-634.